LANDFIRE

Rapid Assessment

Reference Condition Modeling Manual

Version 2.1

January 2005

The following citation should be used in any published materials that reference this document:
***The Nature Conservancy, USDA Forest Service, and Department of the Interior. LANDFIRE Rapid Assessment Modeling Manual, Version 2.1. January 2005. Boulder, CO. 72 pp*.**

The materials in this document were produced under USDA Forest Service, US Department of the Interior, and The Nature Conservancy Cooperative Agreement 04-CA-11132543-189: LANDFIRE—A scientific partnership.

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Introduction

Thank you for agreeing to be a modeler in the LANDFIRE Rapid Assessment! The creation of reference condition models is a critical component of LANDFIRE and the Rapid Assessment, and only with expert help like yours can we succeed in the refinement, development, application, and testing of such models.

Purpose of this Manual

This manual is designed to be a guidebook before, during, and after reference condition modeling workshops. It outlines the standards applied to all LANDFIRE Rapid Assessment models. This manual is not a complete guide to VDDT (Vegetation Dynamics Development Tool); it is meant to accompany other LANDFIRE materials and the VDDT User's Guide that is downloaded with the program.

How Models Will be Used

- Models will be used in the Rapid Assessment to map Fire Regime Condition Class (FRCC) at a mid-scale for the nation.

- Models will replace and/or supplement existing Fire Regime Condition Class Guidebook models as reference conditions for calculating departure.

- Models will be used as first-draft models in the LANDFIRE project. They will be refined and improved in subsequent expert workshops for their mid-scale application in LANDFIRE.

- Models can be used in local and regional planning and management, including project scale FRCC assessments, testing alternative management scenarios, and for developing consensus and a shared vision of the management objectives and desired future conditions for landscapes.

Expectations of Workshop Participants

- learn VDDT modeling techniques as they apply to the Rapid Assessment.
- complete models for all PNVGs in the Rapid Assessment Model Zone.
- provide peer review of other expert's models.
- define spatial rules for mapping PNVGs.
- develop understanding of the applications and importance of LANDFIRE, the Rapid Assessment, and Fire Regime Condition Class Guidebook.

We welcome your feedback and comments on this manual and the modeling process. Please send comments to:

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Contacts

See also Appendix C for workshop contacts by region.

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Chapter 1: Background

On August 8, 2000, the President asked the Secretaries of the U. S. Department of Agriculture (USDA) and the Department of the Interior (DOI) to prepare a report recommending how to respond to severe, ongoing fire activity, reduce impacts of fires on rural communities and the environment, and ensure sufficient firefighting resources in the future. The report, officially titled *Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President In Response to the Wildfires of 2000*, became known as the National Fire Plan (NFP). On October 13, 2000, the USDA Forest Service (USFS) delivered *A Cohesive Strategy: The Forest Service Management Response to the General Accounting Office Report GAO/RCED-99-65.* The National Association of State Foresters and the U.S. Department of the Interior participated with the USFS in developing this report. This report is referred to as the Cohesive Strategy.

In May of 2002, the Secretary of the Interior, Secretary of Agriculture, Director of the Council on Environmental Quality, and the Governors of the States of Montana, Arizona, Oregon, and Idaho met to approve an implementation plan for the *10-Year Comprehensive Strategy, A Collaborative Approach for Reducing Wildland Fire Risks to Communities and Environment.* A total of 17 Governors have since adopted this plan as way to tackle the complex problems of wildland fire. The NFP, the Cohesive Strategy, and the 10-Year Comprehensive Strategy identify the need to invest in long-term solutions to the buildup of excessive hazardous fuels that threaten lives, property, and resources. Three nationally consistent, strategic data and inventory projects are being implemented to address the need for long term solutions: LANDFIRE, the Rapid Assessment, and project-scale Fire Regime Condition Class Guidebook.

LANDFIRE

The LANDFIRE prototype project was conceived in 1999 and funded in 2002 to develop a comprehensive suite of standardized, multi-scale spatial data layers and software (Box 1.1) needed to support the National Fire Plan, the Western States' 10-year comprehensive plan, and the President's Healthy Forest Initiative. The prototype is currently being completed by the USFS, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (MFSL) and USGS EROS Data center in Sioux Falls, South Dakota (EDC) for two large areas in Central Utah and the Northern Rocky Mountains.

Box 1.1: Example LANDFIRE Products

Data Layers

- ► Historical fire regimes
- ► Fire Regime Condition Class (FRCC)
- ► Biophysical settings
- ► Potential vegetation
- ► Existing vegetation
- ► Existing structural stages
- ► FARSITE data layers

Computer Models

- ■ Landscape Simulation (LANDSUM)
- ■ Vegetation Dynamics (VDDT)

The LANDFIRE products are designed to be nationally consistent, locally relevant, and based on current, peer-reviewed scientific methods. The General Accounting Office described LANDFIRE in a 2003 report as "the only proposed research project so far that appears capable of producing consistent national inventory data for improving the prioritization of fuel projects and communities" and has recommended national implementation of the LANDFIRE Project.

In October of 2003, the Wildland Fire Leadership Council sanctioned national implementation of LANDFIRE, and a national organizational structure was developed. National implementation will apply methods developed, tested, and refined through the western U.S. prototypes. The full suite of LANDFIRE products includes over 100 goespatial data layers and computer models (Box 1.1), including vegetation dynamics state-transition models. Products will be delivered by mapzone (Figure 1.1) from 2005 through 2009.

The LANDFIRE process includes using remotely sensed imagery and field plot data to determine existing vegetation composition and structure. Quantitative ecological models are created via expert workshops and paired with existing and potential vegetation types to model historical fire regimes and Fire Regime Condition Class (FRCC).

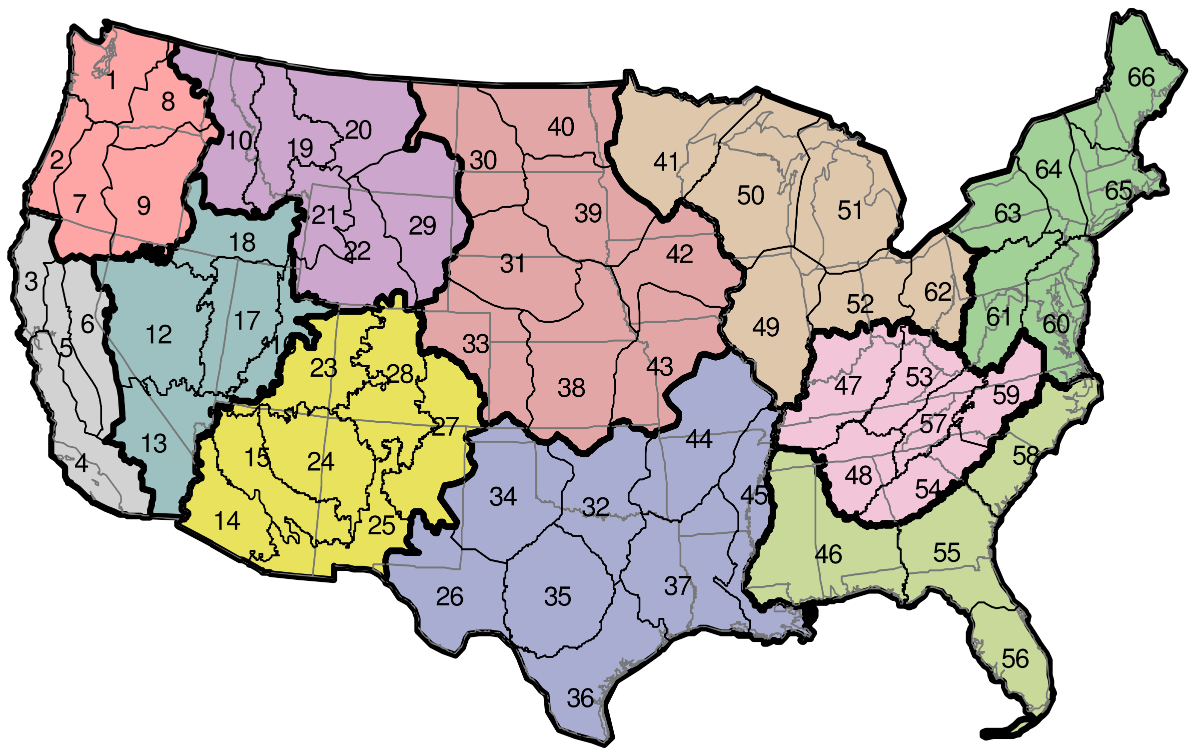

Figure 1.1: LANDFIRE map zones (numbered) and Rapid Assessment model zones (colored). Products will be completed for the Rapid Assessment in the summer of 2005. LANDFIRE products will be completed and delivered by map zone in 2005-2009.

The Rapid Assessment

LANDFIRE includes a Rapid Assessment, which will map and model Fire Regime Condition Class (FRCC) at a broad-scale (e.g., 4th code watershed) resolution for the entire United States by summer of 2005. The Rapid Assessment is designed to fill data needs before the entire suite of LANDFIRE products is available and will be replaced by LANDFIRE data. Additionally, the Rapid Assessment will help to refine vegetation dynamics models for use in regional and local FRCC assessments and these will provide templates for LANDFIRE quantitative vegetation dynamics models (Figure 1.2). The Rapid Assessment also provides technology transfer in the use of LANDFIRE data and the applications of Fire Regime Condition Class.

The Rapid Assessment process includes acquiring existing vegetation data and pairing it with potential vegetation data and quantitative state-transition vegetation dynamics models to map Fire Regime Condition Class.

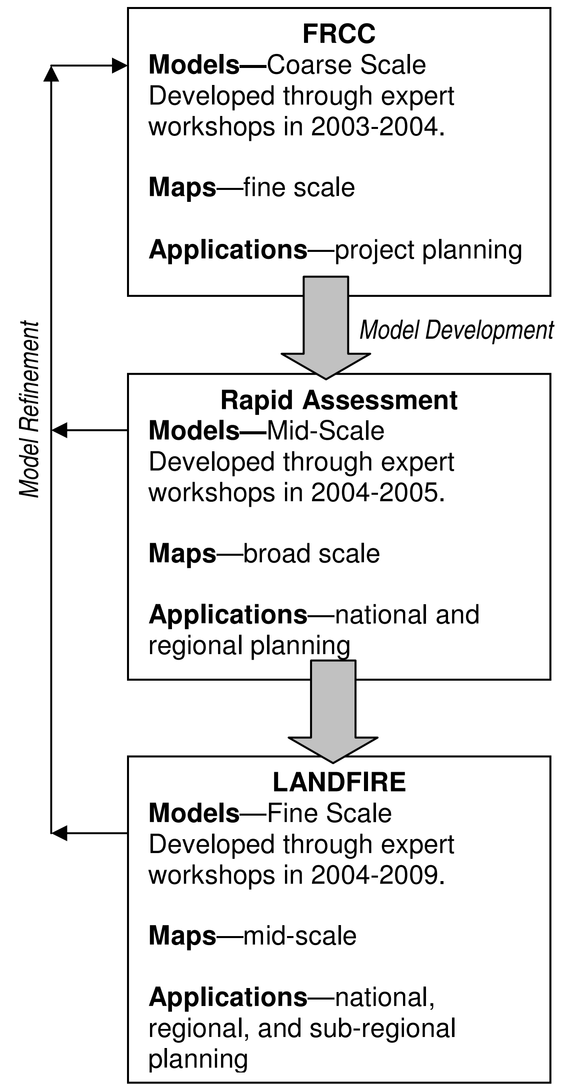

Figure 1.2: Scale and development of models for nationally consistent fire/fuels projects

Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is an interagency, standardized index for determining the degree of departure from the historic range of variability in vegetation, fuels, and disturbance regimes (Table 1.1)[1, 2]. Assessing FRCC can help guide management objectives, help set priorities for treatments, and is mandated by federal agencies and incorporated into the US Healthy Forests Restoration Act as a monitoring measure.

A coarse-scale, national map of Fire Regime Condition Class was created in 2002[1]. Regional and local training and assessments of FRCC are currently being conducted across the United States under the protocol of the FRCC Guidebook[2]. The Rapid Assessment and LANDFIRE will provide nationally consistent FRCC data that will allow for national and regional prioritization. The Rapid Assessment and LANDFIRE will not replace regional or local FRCC Guidebook assessments.

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[1] Schmidt, Kirsten M., Menakis, James P., Hardy, Colin C., Hann, Wendel J., and Bunnell, David L. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. General Technical Report RMRS-GTR-87. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 41 p. Available at: www.fs.fed.us/fire/fuelman.

[2] Hann, Wendel J. et al. 2004. Interagency Fire Regime Condition Class Guidebook. Available at: www.frcc.gov.

Table 1.1: Definitions of Fire Regime Condition Classes

Fire Regime Condition Class	Fire Regime	Ecosystem Components
FRCC 1	Fire regimes are within historical range.	Risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within the historical range.
FRCC 2	Fire regimes have been moderately altered from their historical range. Fire frequencies are departed from historical frequencies by one or more return interval (either increased or decreased).	Risk of losing key ecosystem components is moderate. Vegetation attributes have been moderately altered from their historical range.
FRCC 3	Fire regimes have been significantly altered from their historical range. Fire frequencies are departed from historical frequencies by multiple return intervals (either increased or decreased).	The risk of losing key ecosystem components is high. Vegetation attributes have been significantly altered from their historical range.

The FRCC Guidebook methodology includes determining the departure in current vegetation composition/structure and fire frequency/severity from the historic range of variability, or reference conditions. Reference conditions are created using quantitative state-transition vegetation dynamics models, generated by experts. Models for the much of the US exist or are being developed through the FRCC Guidebook. Models developed for the Rapid Assessment and LANDFIRE will replace FRCC Guidebook models because they will be finer resolution and have more expert input (Figure 1.2).

Quantitative Vegetation Dynamics Models

Vegetation dynamics models for the FRCC Guidebook, the Rapid Assessment, and LANDFIRE are quantitative, state-transition (box) models. Modeling is necessary to determine the historic range of variability in vegetation composition and structure. All projects use the modeling software VDDT[3] (Vegetation Dynamics Development Tool; Figure 1.3), which is a public domain, aspatial tool (available at www.essa.com).

Models for all three projects are developed during workshops where regional vegetation and fire ecology experts synthesize the best available data on vegetation dynamics and disturbance for vegetation groups in their region. Most experts will be trained in VDDT software and generate models during the workshop. For the FRCC Guidebook and the Rapid Assessment, models are

[3] Beukema, S. J., Kurz, W.A., Pinkham, C.B., Milosheva, K. and Frid, L. 2003. Vegetation dynamics development tool User's Guide, Version 4.4c. Prepared by ESSA Technologies, Ldt., Vancouver, BC. 239 pp. Available at: www.essa.com.

based on a simple 5-box model (Table 1.2), which combines two structure classes with three cover type classes. Models for LANDFIRE may be more complex.

Quantitative models are based on inputs such as fire frequency and severity, the probability of other disturbances, and the rate of vegetation growth. Inputs are derived from literature review and expert input during and after modeling workshops. Models simulate several centuries of vegetation dynamics and outputs such as percent of landscape in each class and the frequency of disturbance are recorded (Figure 1.4). Outputs are checked against available data whenever possible and are peer-reviewed during and after expert workshops. These outputs are then used to calculate FRCC using the Guidebook methodology.

Table 1.2. The standard five-box model classes. Models for the FRCC Guidebook and the Rapid Assessment use this standard model with modifications as needed. Letters represent unique classes and correspond to boxes in the state-transition models (Figure 1.3).

	Structural Stage	
Cover Type	**Closed**	**Open**
Early development	A	
Mid-development	B	C
Late-development	E	D

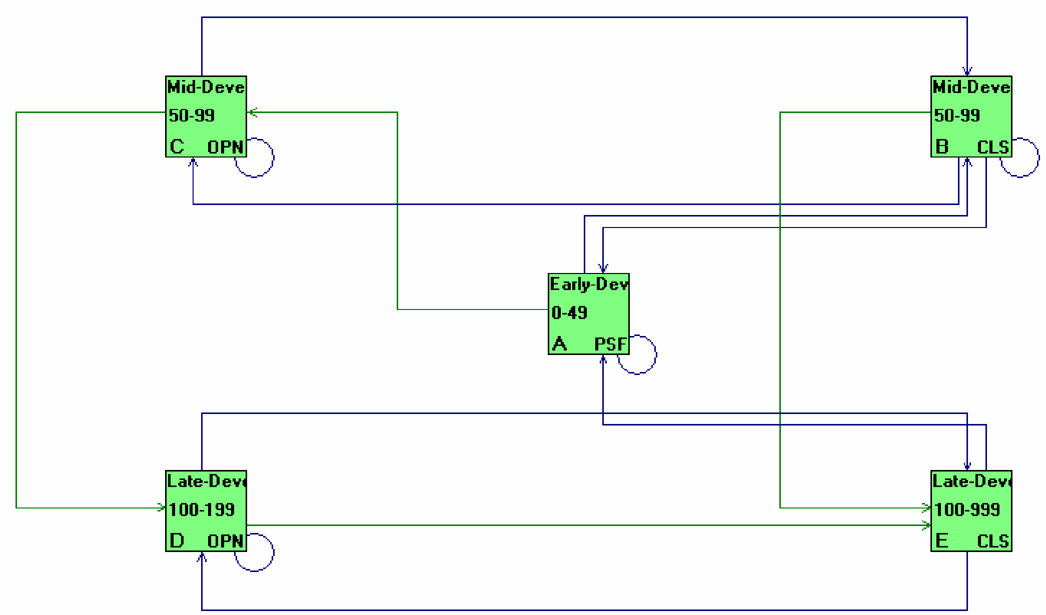


Figure 1.3: A typical VDDT state-transition model. Each box represents a vegetation class made up of characteristic vegetation composition and structure. Each arrow represents a transition from one class to another based on vegetation growth (succession) or a disturbance (e.g., fire or other).

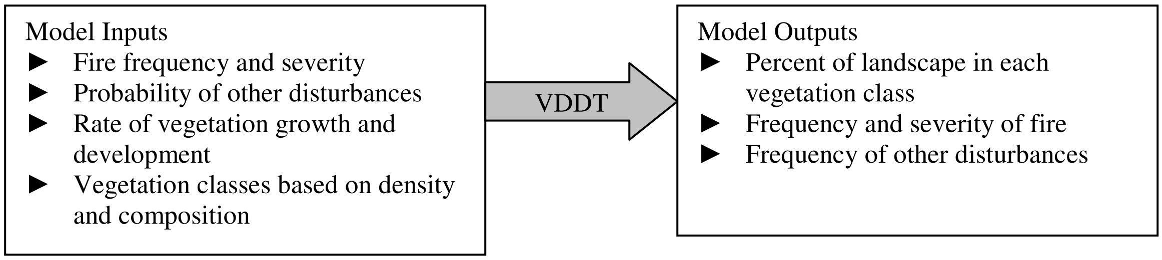


Figure 1.4: Inputs and Outputs to VDDT models.

For More Information

Please see Appendix A for links and additional resources. Appendix B contains letters of support from the USDA Forest Service, the Bureau of Land Management, and the US Fish and Wildlife Service. Appendix C contains a national schedule and information bulletin about Rapid Assessment modeling workshops. You may also contact LANDFIRE staff, listed immediately preceding this chapter.

Chapter 2: Potential Natural Vegetation Groups

Table 2.1: Potential Natural Vegetation

Potential Natural Vegetation	
Definition	The vegetation that would exist under the historic range of variability, with natural disturbances, and in the absence of modern human interference.
Applications	Originally based on Kuchler[4], PNV was used in the Coarse Scale project[5] and further refined for use in the FRCC Guidebook[6] and LANDFIRE's Rapid Assessment.

The FRCC Guidebook and the Rapid Assessment rely on the concept *of potential natural vegetation* (PNV). Potential natural vegetation is a biophysical classification based on Kuchler[4], used in the Coarse Scale FRCC mapping project[5], and refined for use in the FRCC Guidebook[6] and the Rapid Assessment. PNV is defined as *the vegetation that would exist under the historic range of variability, with natural disturbances, and in the absence of modern human interference* (Table 2.1).

Undoubtedly, there are regional and local classifications preferred over PNVG for local applications. However, given the requirements of the Rapid Assessment and LANDFIRE, we must use a nationally consistent classification. Crosswalks between the PNVs developed for the Rapid Assessment and local/regional classifications can be developed regionally with help from the national Rapid Assessment modeling team. Experts at workshops will also work to cross-walk PNV with Ecological Systems[7], a nationally consistent, hierarchical vegetation classification that will be used for LANDFIRE resolution models. For more information about Ecological Systems, please visit *www.natureserve.org*.

For modeling reference conditions in the Rapid Assessment, potential natural vegetation is grouped to form broad-scale associations called potential natural vegetation groups (PNVGs). Development of reference models for the Rapid Assessment begins with those PNVGs already developed for the FRCC Guidebook. An entire list of PNVGs developed for the Guidebook can be found at www.frcc.gov and in Appendix D of this manual. The list of PNVGs will be refined and improved during expert workshops in each model zone. Refinement includes listing new PNVGs, identifying PNVGs that need to be split into two or more PNVGs, identifying PNVGs that need to be lumped with another group, and deleting PNVGs that do not apply to the model zone. The process for refining the PNVG list is below.

[4] Kuchler A. W. 1964. Potential natural vegetation of the conterminous United States (manual and map). Special Publication 36. New York: American Geographical Society. 116 p.

[5] Schmidt, Kirsten M., Menakis, James P., Hardy, Colin C., Hann, Wendel J., and Bunnell, David L. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. General Technical Report RMRS-GTR-87. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 41 p. Available at: www.fs.fed.us/fire/fuelman**.**

[6] Hann, Wendel J. et al. 2004. Interagency Fire Regime Condition Class Guidebook. Available at: www.frcc.gov.

[7] Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. *Ecological Systems of the United States: A Working Classification of U.S. TerrestrialSystems.* NatureServe, Arlington, Virginia. Available at: http://www.natureserve.org/getData/ecologyData.jsp.

Steps to Refine the Regional PNVG List

During workshops, small groups will take the list of relevant FRCC PNVGs (Appendix D) and go through this decision matrix. Groups will be provided with a poster for tracking the progress of each PNVG.

For existing FRCC PNVGs:

1. *Guideline: Does this type occur in the model zone and occupy ≥3% of the model zone, or does it play a significant role in your region?* If no, ignore the PNVG.

2. *If yes, does the description fit?* Review the FRCC Interagency Handbook Reference Condition model description:

   Descriptive information:
   - Vegetation/PNVG description ("Description"). *Do the **general** site, species composition, and structural descriptions fit?* (You can add more information later.)

   - Vegetation class descriptions ("Vegetation Type and Structure" table—"Description" column). *Do the general descriptions of each vegetation class (A-E) fit?* (You can add more information later.)

   Quantitative information:
   - Fire frequency ("Fire Frequency and Severity"). *Guideline: Is the fire frequency within +/- 25% of reference conditions?* (Probabilities in the "Fire Frequency and Severity" table represent the central tendencies of annual frequencies. To determine annual frequency, take 1/probability.

   - Vegetation mosaic description ("Vegetation Type and Structure" table—"Percent of Landscape" column). *General Guideline: Is the percent of landscape in each vegetation class (A-E) within +/- 10% of what you'd expect under reference conditions?*

3. If the description *generally* fits, assign a single lead expert to each PNVG. This person will coordinate the development of the PNVG throughout the workshop. Determine which type of changes need to made and list it on your poster:

Descriptive changes to existing PNVG………….	**a) Put the description into the database** **b) Add regional information and more detail**
Descriptive and quantitative changes to existing PNVG…………………………………………………	**a) Put the description into the database** **b) Add regional information and more detail** **c) Make necessary changes to existing VDDT model**

4. If the description does not fit, list it as a new PNVG on your poster.

5. List additional PNVGs that were not previously modeled that should be modeled this week. Additional new PNVGs should generally:
   - Occupy ≥3% of the model zone
   - Have a significantly different fire regime from the most similar PNVG (≥25% difference in fire frequency).
   - Be mappable by biophysical gradients (e.g., elevation, precipitation) and geographic area (e.g., Bailey's section, mapzones)

6. Assign a lead modeler to each new PNVG. This person will coordinate the development of the PNVG throughout the week.

For each new PNVG……	**a) Describe the PNVG in the database with as much detail as possible** **b) Create a new VDDT model using one of the blank templates.**

Chapter 3: Installing VDDT and Data Files

Installing VDDT

Prior to the workshop:

- ⇨ visit www.essa.com[8] and go to Downloads—Software—VDDT Download Page.
- ⇨ Follow the instructions for downloading and installing VDDT. You will need to email ESSA for a password, so do this several weeks prior to the workshop.
- ⇨ Test the functioning of VDDT by running one of the demo models that comes with the program.
- ⇨ Proceed to the next section, File Structure and Data Files.

This option is recommended for Federal employees and required if you do not have administrative privileges on your laptop.

Or, at the workshop:

- ⇨ Copy the folder labeled VDDT from the workshop CD directly into your C:\ drive. VDDT works best when it is immediately under a root directory.

- ⇨ Open the folder and double-click on the file called VDDT-exe-44c.exe. This will install the program for you. When prompted, install the program into the C:\VDDT directory. You will be prompted for a password that the workshop leaders will provide. For more information about VDDT, see Box 3.1 or the User's Guide[8].

- ⇨ Continue onto the next section, File Structure and Data Files.

Box 3.1: About VDDT

For more information, visit www.essa.com or check the VDDT User's Guide[8].

History

- → VDDT is public domain and was originally developed for the Interior Columbia River Basin Ecosystem Management Project.
- → VDDT is used in nationally consistent fire and fuels projects like LANDFIRE and Fire Regime Condition Class, and at project scales in land management or conservation planning.

Model Assumptions

- → VDDT is non-spatial; terrain and contagion are not incorporated. VDDT can be paired companion spatial programs, including TELSA and LANDSUM, which combines VDDT models and spatial data.
- → The user must stratify the landscape into units with similar succession and disturbance characteristics, like Potential Natural Vegetation Groups.

How the Model Works

- → The user defines classes on the landscape by composition, structure, and age; assigns a main successional pathway; and assigns probabilities and pathways for different disturbances.
- → VDDT partitions the landscape into a user-determined number of pixels (e.g., grid cells). Each pixel is initially assigned to a class and age.
- → When the model is run, VDDT stochastically simulates the probability of disturbance. If a disturbance does not occur, pixels are moved along the pathway defined as succession.

[8] Beukema, S. J., Kurz, W.A., Pinkham, C.B., Milosheva, K. and Frid, L. 2003. Vegetation dynamics development tool User's Guide, Version 4.4c. Prepared by ESSA Technologies, Ldt., Vancouver, BC. 239 pp. Available at: www.essa.com.

File Structure and Data Files

1. Copy the folder called RAModeling directly into the C:\VDDT folder.

2. Open the RAModeling folder. You should see 8 folders and a database file:
   - 🗁 3BoxModel
   - 🗁 4BoxModel
   - 🗁 5BoxModel
   - 🗁 DefinitionFiles
   - 🗁 MyModels
   - 🗁 RA Modeling Help
   - 🗁 VDDT Test
   - 🗁 Windows Troubleshooting
   - 🗋 ModelTracker2.0.mdb

3. Right-click on the folder called MyModels, select Rename, and type your last name. This is where you will store all of the models you develop for the Rapid Assessment. For each model, you'll create a folder named with a unique PNVG code.

4. Right-click on the file called ModelTracker2.0.mdb, select Rename, and type your last name. This is the database where you'll document the assumptions, inputs, and outputs of all the models you create.

5. Highlight the folders 3BoxModel, 4BoxModel, 5BoxModel, DefinitionFiles, and VDDT Test (hold down the control key while clicking on the files). Right-click and select Properties. Make sure the checkbox for Read-Only is NOT checked. Click Apply and OK. If you are asked if you want to apply the changes to all files within the folders, select yes.

Testing VDDT

Some Windows users encounter problems when running VDDT the first few times. If you encounter run-time errors, crash VDDT, or have trouble showing graphs, reference *Appendix E: Troubleshooting VDDT*. The following steps will quickly test the functioning of VDDT on your computer. These steps are outlined in greater detail in the rest of the Manual.

1. Open VDDT. You can access VDDT from the Start Menu or from an icon on your desktop.

2. Go to File—Use New Definition Files—All Files. Be sure to select All Files or VDDT won't run properly. You will get an informational message; click OK.

3. Navigate to the DefinitionFiles folder (C:\VDDT\RAModeling\DefinitionFiles). You should see file called distcode.txt. Double-click it.

4. Go to File—Open PVT Files. Navigate to the VDDT Test folder (C:\VDDT\RAModeling\VDDT Test). You should see a file called TestVDDT.PVT. Double-click it.

5. VDDT will prompt you to select SCN and LOC files. Each time, double-click on the TestVDDT.SCN or TestVDDT.LOC files. The model should now appear.

6. Double-click on any of the green boxes. The parameters of that class should appear. If you encounter an error or crash VDDT, check Appendix E. Close the dialogue box.

7. Go to Run Model—Edit Initial Conditions. Hit the button that says Recalc at the bottom of the dialogue box.

8. Go to Run Model—Select TSD Group. Check the box next to AllFire.

9. Go to Run Model—Run. You should see a progress bar. If you encounter an error or crash VDDT, check Appendix E.

10. Go to Results—Bar—Class. A graph displaying the results of your model should appear. If you encounter an error or crash VDDT, check Appendix E.

11. If you did not encounter any errors, VDDT is working on your machine! Congratulations—you are now a modeler.

Chapter 4: Starting a New Model

In the Rapid Assessment, there are two options for starting a new model (Also see the VDDT User's Guide[9], section 4.5 to learn about creating your own model from scratch). The Modeling Cheatsheet (Appendix F) provides easy step-by-step instructions for starting a new model.

Starting From a Blank Template

There are three options for templates: 5-box, 4-box, and 3-box models (Table 4.1). You will want to select the template that is most appropriate for your system. Templates provide a blank model structure—no succession or disturbances have been attributed.

Table 4.1: Templates for Rapid Assessment models

Model	Most Common Uses	Template Location
5-Box Model	• Forested systems • Complex shrublands	C:\VDDT\Rapid Assessment\5BoxModel
4-Box Model	• Shrublands with trees • Grasslands with shrubs	C:\VDDT\Rapid Assessment\4BoxModel
3-Box Model	• Grasslands • Simple shrublands	C:\VDDT\Rapid Assessment\3BoxModel

Starting From an Existing Model

There are currently over 160 models available as starting points, created through the FRCC Guidebook[10]. Some of these models will be appropriate starting points for your Rapid Assessment models. They can all be found on the workshop CD under FRCC Models. In the FRCC Models folder, you can find the following:

- 🗋 Index to FRCC PNVGs.[east or west] pdf. This shows the PNVG code, long name, geographic area, and fire regime group for all FRCC PNVGs in the east or west.

- 🗁 A file for each PNVG, named by the PNVG code. Within each PNVG file, you can find:
  - 🗁 DocsPhotosFigs (may not be present for all PNVGs), which contains photographs, research information, and other documentation for the model.
  - 🗋 Description Document named *_Description.pdf, which is the description document showing the assumptions and results of the FRCC model.
  - 🗋 VDDT files, named *.pvt, *.loc, and *.scn.

[9] Beukema, S. J., Kurz, W.A., Pinkham, C.B., Milosheva, K. and Frid, L. 2003. Vegetation dynamics development tool User's Guide, Version 4.4c. Prepared by ESSA Technologies, Ldt., Vancouver, BC. 239 pp. Available at: www.essa.com.
[10] Hann, Wendel J. et al. 2004. Interagency Fire Regime Condition Class Guidebook. Available at: www.frcc.gov.

Loading a Model

1. Open VDDT. Double-click its icon on your desktop or navigate to C:/VDDT.

Every time you open VDDT, you must redirect the program to your 5 definition files.

2. Click on <u>File—Use New Definition Files – All Files</u>. Click OK when the dialogue box pops up noting that all 5 definition files must be in the same location. These files define cover, structure, and disturbance and VDDT requires that they be used. These files are explained in further detail in Table 4.2. Note that a set of the 5 text files (dummy files) must always be in the same directory as your VDDT executable—do not delete these dummy text files from the VDDT directory.

Table 4.2: The five definition files used in Rapid Assessment models.

Definition File	Rapid Assessment
Cover.txt *Names of cover types*	• Early-Development 1 • Early-Development 2 • Early-Development 3 • Mid-Development 1 • Mid-Development 2 • Mid-Development 3 • Late-Development 1 • Late-Development 2 • Late-Development 3
Coverc.txt *Abbreviations of cover type names*	• Early1 • Early2 • Early3 • Mid1 • Mid2 • Mid3 • Late1 • Late2 • Late3
Structur.txt *Structural classes (abbreviated)*	• All (All structures) • Cls (Closed)) • Opn (Open)
Distcode.txt *Disturbance types available to use.*	There are 10 disturbance types. See Table 6.2 for definitions.
Distgrp.txt *Groups disturbances into hierarchical categories.*	There are 3 major disturbance groups. See Table 6.2 for definitions.

3. Navigate to the Rapid Assessment definition files, found here: C:\VDDT\RAModeling\DefinitionFiles. Double-click on the distcode file. VDDT will automatically recognize the other 4 definition files because they are in the same directory.

4. Click on <u>File—Open PVT Files</u>. Navigate to the desired template model and double-click its PVT file. Make sure the template model's files are not Read-Only. VDDT will now ask you to locate the model's SCN and LOC files.

5. Save your model with a new name.
   - Click on File—Save Files As (New Format).

   - Navigate to the folder named with your last name (C:\VDDT\RAModeling\My Models).

   - Create a new folder (click the button that looks like an exploding folder) in your last-name folder. Name the new folder with the code of your PNVG. Double-click the new folder to open it.

   - In the File Name box at the bottom, type the unique PNVG code.

   - Click save; you will click save three times, once for the PVT, SCN, and LOC files. Note: if an asterisk appears in the title of the file, you will have to delete it before clicking save.

   - You are now able to manipulate the model; remember to save frequently (File—Save Files).

Chapter 5: About Classes (Boxes) and Transitions (Arrows)

State (Box) Definitions

1. Each green box in the VDDT successional pathway diagram (SPD) represents a succession class. These classes are user-defined combinations of composition and structure (Figure 5.1).

2. In Rapid Assessment modeling, there can be no more than five successional classes (boxes), but you can have fewer than five. The standard five classes are based on combinations of structural stage and cover type (Table 1.2), but these can be changed by the user:
   - A: early development, post-replacement
   - B: mid-development closed
   - C: mid-development open
   - D: late development open
   - E: late development closed

The structural stages (open, closed, and all) are defined by the user in model documentation based on cover breaks. These vary greatly between PNVGs. The cover types (early, mid-, and late) are also user-defined in model documentation.

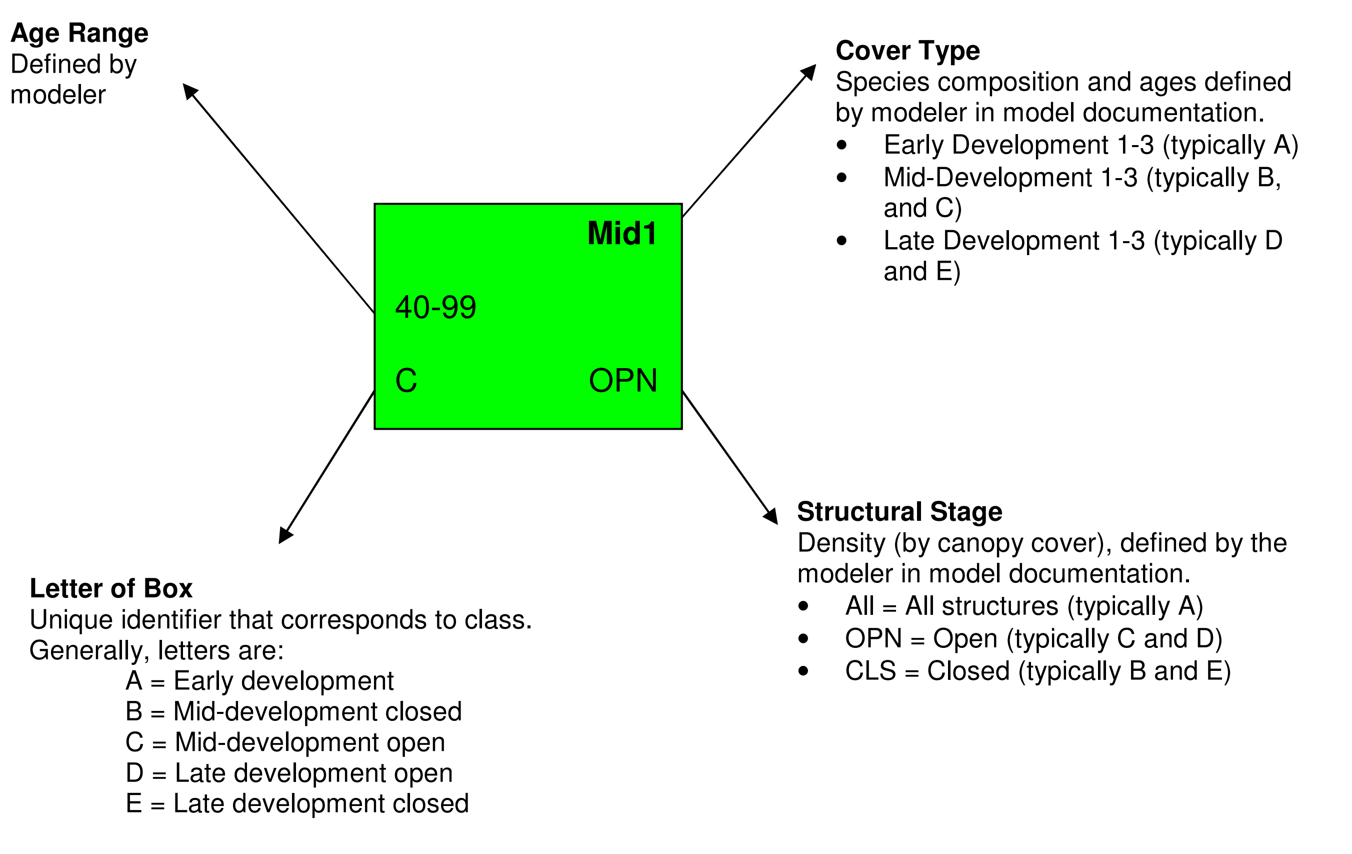


Figure 5.1: Anatomy of a Rapid Assessment box (class) in VDDT. Also see Table 1.2 for a description of each of the five classes (boxes) used.

3. VDDT will not allow users to have two boxes with the same cover/structure combination. If two of your boxes are identical in development (e.g., mid) and in structure (e.g., open), but have different composition and warrant being separate boxes, you may choose to change the name of one of the boxes. There are up to 27 structure/composition combinations (Table 5.1), but each model can have a maximum of 5 boxes.

Table 5.1: Cover-Structure Combination Options

Cover Type Options	***Structural Stage Options***
Early1	All
Early2	Closed
Early3	Open
Mid1	
Mid2	
Mid3	
Late1	
Late2	
Late3	

To change the name (structure/cover combination) of a box:

- Go to Diagram—Edit a class.
- In the Edit A Class dialogue box, type the letter of the class (A-E) to edit in the Class Label box.
- From the Cover Type drop-down menu, select the cover type for the class. Always use the class number in sequence (e.g., start with 1, then 2, etc.).
- From the Structural Stage drop-down menu, select the structural stage.

Transition (Arrow) Definitions

Each line and arrow in the SPD represents a pathway between succession classes, resulting from either disturbances (blue lines) or succession (green lines). You can change the pathways viewed in the SPD by:

1. Selecting Diagram and Redraw Pathways. In the dialogue box, select which pathways you want VDDT to show and click Draw.
2. You can view the pathways that only affect one box by right-clicking on that box. To redraw all pathways, select Diagram, Redraw Pathways, All Class Changes, Draw.

Chapter 6: Attributing the Model

You may want to use a worksheet to help you keep track of changes you make to each model. An example worksheet is in Appendix G. The Cheatsheet in Appendix F also walks you through attributing the model.

Users must attribute two components in VDDT models: succession and disturbance. They are explained in more detail in sections below and in the *VDDT User's Guide*[11], which comes with the program.

How the model treats Succession and Disturbance

Succession. VDDT treats a single succession pathway deterministically. After the designated number of timesteps (the age range for a class), a pixel transitions along the main succession pathway, designated by the user. Users can also attribute alternative succession pathways as disturbances.

Disturbance. VDDT treats multiple disturbance pathways probabilistically. Each year, VDDT stochastically simulates whether or not a disturbance happens to each individual pixel within a class based on the probability of that disturbance, input by the user. (Probability is equal to 1/ annual frequency of that disturbance.) If a disturbance occurs, the pixel moves along the designated pathway. The pixels that remain in the class at the end of the age range for that class are then affected by succession.

Attributing the Main Succession Pathway

- Double-click on the box you wish to attribute. The Pathways From Class dialogue box (Figure 6.1) appears. Note that there are two levels to this dialogue box: the top shows succession in green and the bottom shows disturbances in red.

- In the top (green) section of the box, edit the beginning age box to reflect the average starting age for this developmental stage. For the early-development class (A) this will always be 0 years. For other classes enter the average beginning age for that stage of development across the PNVG.

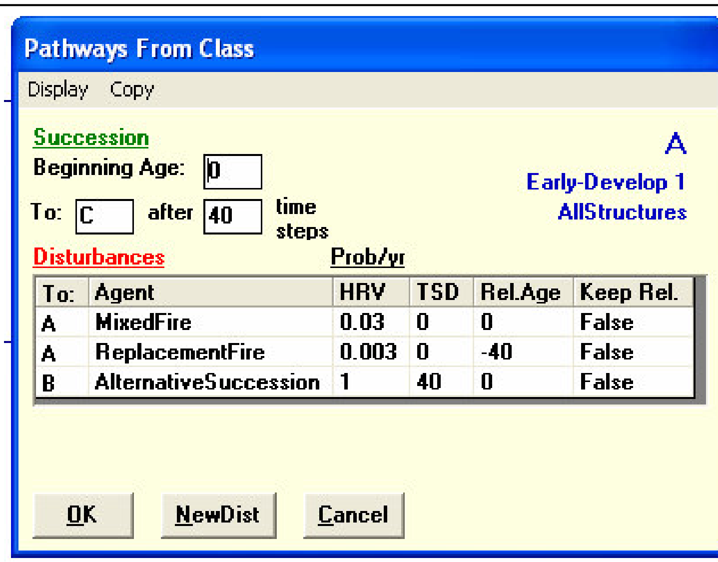


Figure 6.1: Pathways From Class dialogue box. The name (A), cover type (Early-Develop 1), and structural class (AllStructures) is shown in the upper right. The main succession pathway is shown in the upper left (green). The disturbance pathways and probabilities are shown in the bottom table (red).

[11] Beukema, S. J., Kurz, W.A., Pinkham, C.B., Milosheva, K. and Frid, L. 2003. Vegetation dynamics development tool User's Guide, Version 4.4c. Prepared by ESSA Technologies, Ldt., Vancouver, BC. 239 pp. Available at: www.essa.com.

- Edit the succession To box to reflect the dominant pathway of change for this PNVG. Succession will follow one of these pathways:
    - Maintenance. The dominant change (To) pathway acts to maintain a class (for example, D to D or E to E). This typically only happens in the late-development classes.

    - Transition. The dominant change (To) follows a path towards a later developmental stage. The transition can take you either:
        - Toward a closed structural class (for example, A to B to E). This is the typical succession pathway in systems with infrequent fire or slow growth
        - Toward an open structural class (for example, A to C to D). This is the typical succession pathway in systems with frequent surface or mixed fire disturbances that maintain the open structure and promote the development of the upper vegetation layer to a later (older) stage.

> The ending age of one box should generally line up with the beginning age of the next class in the succession pathway. For example, if your pathway goes from B to E and if B ends at 99, E should start at 100.

- Edit the after time steps box to reflect the amount of years it takes to move to the next class. Note this is not the ending age; it is the average number of years added to a pixel in that class. To determine you're ending age, add the beginning age and the time steps.

Attributing Alternative Succession Pathways

Alternative succession pathways can be attributed one of two ways: as probabilistic transitions ("disturbance") or as occurring only in the absence of another disturbance (e.g., fire) using Time Since Disturbance (TSD). The decision matrix in figure 6.2 may help you determine how to attribute alternative succession pathways.

Alternative Succession as a Probabilistic Transition

Alternative succession is generally treated as a probabilistic transition in systems with infrequent fire.

- Double-click on the box you wish to attribute. The Pathways From Class dialogue box appears (Figure 6.1). Note that there are two levels to this dialogue box: the top shows deterministic transitions (succession) in green and the bottom shows probabilistic transitions (disturbances) in red.

- Add Alternative Succession to the probabilistic transitions by clicking on the NewDist button and selecting AltSucc from the drop-down menu. Note that you can add more than one alternative succession pathway; just add AltSucc multiple times to your box and select different pathways for each.

- Define the alternative succession pathway under the To column (i.e., to which box does the alternative succession send a pixel).

- Enter a probability in the HRV column. Probabilities are the inverse of years (probability = 1/yearly frequency). Table 6.1 is a quick reference of years and associated probabilities.

Alternative Succession in the Absence of Another Disturbance (TSD)
In most PNVGs that are fire maintained (e.g., Fire Regime Group I, II, and sometimes III), the main (deterministic) succession pathway will be towards open canopy classes. In these classes, any kind of alternative succession will happen only in the *absence* of fire. We can use Time Since Disturbance (TSD) to control the movement of pixels based on the time since a disturbance. For example, if the dominant pathway is from C to D, C should arrive at B only after the specified number of years since fire. Figure 6.2 is a dichotomous key that will help you determine when to use TSD.

- Double-click on the box you wish to attribute. The Pathways From Class dialogue box appears (Figure 6.1). Note that there are two levels to this dialogue box: the top shows deterministic transitions (succession) in green and the bottom shows probabilistic transitions (disturbances) in red.

- Add Alternative Succession to the probabilistic transitions by clicking on the NewDist button and selecting AltSucc from the drop-down menu. Note that you can add more than one alternative succession pathway; just add AltSucc multiple times to your box and select different pathways for each.

- Display the TSD column by double selecting the Display menu. Click on Show TSD col.

- Enter a number in the TSD column that reflects the amount of time it would take in the absence of fire to advance in age from an one class to another. You may also want to think about this in terms of number of fire cycles missed. For example, for an open mid-development class (C) to develop into a closed mid-development class, there must be no fires for at least 30 years. Or, in order for a type C to become a type B, at least two 15-year fire cycles must be missed.

- Enter a probability of 1. This tells the model that a pixel will always move to the specified class if the time since disturbance reaches the specified number of years. For example, if you attribute a model so that a pixel will move from C to B when TSD is 30 under a probability of 1 (and set the disturbance for TSD to AllFire), all pixels left after 30 years that have not experience a fire during those 30 years will advance to B.

- When you run the model, be sure to select Run Model—Select TSD Group and select AllFire. (Note that in Rapid Assessment models we always use AllFire as the TSD Group, but VDDT will allow you to select any disturbance group.)

Attributing Disturbances

Disturbance can only cause transitions that (a) maintain a class or (b) reduce the age of a class. Disturbance cannot advance the age of a class (i.e., fire cannot change pixels from class mid-development C or B to late-development D or E)—only succession or alternative succession can advance the age of a class.

1. Double-click on the box you wish to attribute. The Pathways From Class dialogue box appears (Figure 6.1). Note that there are two levels to this dialogue box: the top shows succession in green and the bottom shows disturbances in red.

2. Add disturbances by selecting NewDist and picking the disturbance from the drop-down menu.

3. Delete a disturbance by deleting the letter (A-E) in the To: box. An error message will appear that says, "No destination was entered. Do you wish to delete the pathway?" Select Yes.

4. Define the disturbance type that you are attributing under the Agent column. Disturbances used in the Rapid Assessment are defined (and grouped hierarchically) as appears in Table 6.2.

5. Define the pathway this disturbance causes under the To column (i.e., which box does the disturbance send a pixel to). Note that disturbances can have multiple pathways; just add the same disturbance twice to your box and select two different pathways for each.

6. Edit probabilities as necessary under the HRV column. Probabilities are the inverse of years (probability = 1/yearly frequency). Table 6.1 is a quick reference of years and associated probabilities. As a general rule, include only disturbances that would have a noticeable affect on the model. For disturbances that you want to include, but might have minimal affects, use a probability of 0.001.

Table 6.1: Years (frequency) and associated probabilities. Probability is the inverse of frequency.

Year Value	Probability	Year Value	Probability	Year Value	Probability
2	0.500	50	0.020	130	0.008
5	0.200	60	0.017	150	0.007
10	0.100	66	0.015	200	0.005
20	0.050	75	0.013	250	0.004
25	0.040	80	0.013	300	0.003
30	0.033	85	0.012	500	0.002
33	0.030	100	0.010	700	0.001
40	0.025	110	0.009	1000	0.001

Using Relative Age

- In Rapid Assessment models, we will NOT use the Keep Relative (KeepRel) function to maintain consistency. The Keep Rel column should always read FALSE. For more information about the Keep Relative function, see the *VDDT User's Guide*.

- In Rapid Assessment models, ALWAYS use the Relative Age function when you have Replacement Fire in class A (or other disturbances that maintain a class AND retard succession or growth).

  1. Double-click box A to open its attributes.

  2. Find the replacement fire disturbance that maintains the class.

  3. In the RelAge column, enter –n, where n = the number of timesteps a pixel can stay in that class (this should be the number you entered in the Succession To box). See Figure 6.1 for an example. For example, if a pixel moves from A to C in 40 timesteps under succession, but you may maintain A with a replacement fire, enter –40 in relative age (RelAge) on the line showing A to A replacement fire. If you do not use relative age (RelAge), the age of the pixel is not reset to the class beginning age and the disturbance has no effect. By using relative age (RelAge), every pixel affected by the disturbance will be reset to the class beginning age. If the –n number is greater than the age of the pixel, the model does not set the age at a negative age or at an age younger than the beginning age of the class, but sets the age to the beginning age of the class (usually 0 for class A).

Table 6.2: Disturbances used in Rapid Assessment Models and their hierarchical groupings.

Group 1	Group 2	Disturbance Type	Description
All Fire			All fires grouped together for graphing purposes.
	Replacement Fire		Fires that replace the existing vegetation type.
		Replacement Fire	Fires with >75% top-kill. These fires will always replace the existing vegetation type and reset the pixel to class A. You should attribute all events of this type to reset the pixel to class A.
	Non-Replacement Fire		Fires with <75% top-kill, grouped together for graphing purposes.
		Mixed Fire	Mixed severity fires with 25-75% top-kill.
		Surface Fire	Surface fires with less than 25% top-kill.
Non-Fire Disturbances			Disturbances other than fire grouped together for graphing purposes.
		Competition/ Maintenance	Competition and/or lack of seed source maintain your class. This will always be a type that keeps you in a class.
		Insects/ Disease	Insects or disease.
		Wind/ Weather/ Stress	Drought, wind disturbance, and other weather disturbances.
		Native Grazing	Grazing by native animals.
	Optional Types	**Optional 1**	Optional disturbances that are either (a) not included in the categories above or (b) should be singled out from a larger group when data allows. Clearly define and describe optional disturbances in the model documentation.
		Optional 2	
Alternative Succession		**Alternative Succession**	Alternative succession pathway that is different from the primary pathway. Alternative succession can be modeled as a probabilistic transition (i.e., disturbance) or using TSD (Time Since Disturbance). See *Attributing Alternative Succession Pathways* in Chapter 6.

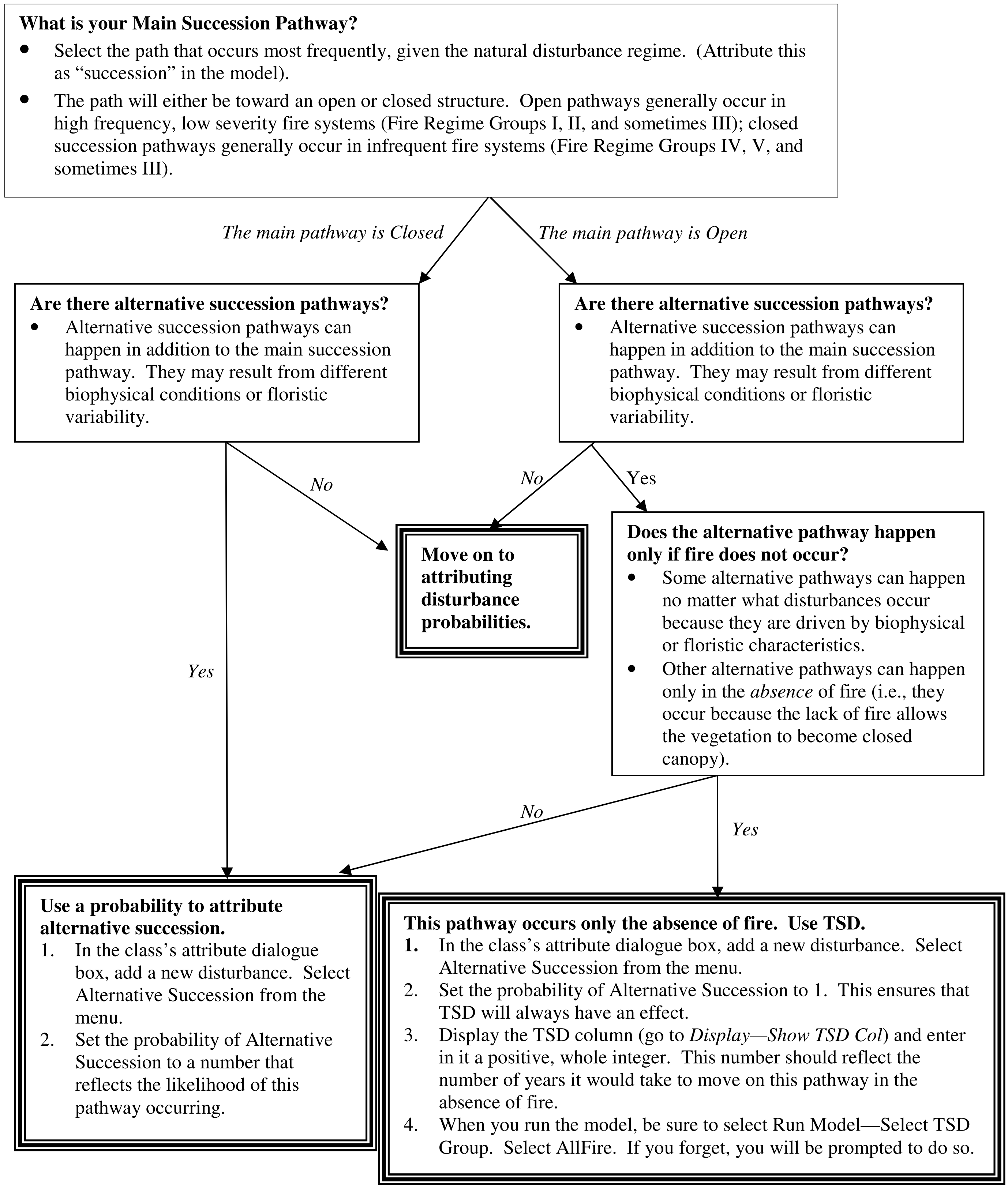


Figure 6.2: Decision Matrix for Attributing Succession. Use this flow-chart to help you determine how to attribute alternative succession pathways.

Modeling Tips

→ Use the Cheatsheet (Appendix F) to help you remember modeling standards.

→ Use the worksheet (Appendix G) to track the changes you make as you model.

→ Expect to do several model runs. Don't strive for perfection until you've run the model 10 times—it will improve (as will your understanding of its sensitivity) with iterations.

→ Use the mean fire frequency as your first input to the model. Adjust other disturbances later.

→ Start by inputting your mean fire frequency (as a probability) the same in every class (box). Go back to change the distribution of fire throughout the classes, if necessary. For example, replacement fire may be more probable in classes B and E than others, but start with an even distribution and tweak the model later.

→ It is helpful to think about disturbance probabilities comparatively. For example, if the probability of Insects/Disease is 0.01 and Fire is 0.10, we're saying fire occurs ten times as often as insect outbreaks (or affects 10 times more of the landscape).

→ Include only those disturbances that affect the model. You will have to run several iterations of the model to test its sensitivity to different disturbances.

→ Disturbance probabilities for fire (and other disturbance groups) are cumulative within a box. For example, surface fire, mosaic fire, and replacement fire are additive within any box.

→ Make sure that the sum of all disturbance probabilities in any given box is <1.00, otherwise each year a disturbance will occur and no pixels will be left for succession to occur.

→ To calibrate models in systems where fire exclusion is an issue today, try turning fire "off" (<u>Run Model—Disable Some Disturbances</u>) and see if the results of the model change the way you'd expect them to.

→ To calibrate fire in a model, graph fire through time (<u>Results—Time—Disturbance</u>). The x-axis shows the percentage of the landscape that is affected by fire (which, in RA models, is also equal to the probability of fire). Test this number against your knowledge of how much of that type would be affected by fire.

Chapter 7: Running a Model and Viewing Results

Running the Model

See Table 7.1 and the Cheatsheet in Appendix F for a quick-guide to running a model.

1. Edit the initial conditions (Figure 7.1). Select Run Model—Edit Initial Conditions. Set the number of pixels to simulate and total area in PVT to 1000. This will simulate 1000 pixels, with each representing one unit of area. Hit ReCalc to distribute the number of pixels evenly throughout your classes. You can also manually distribute the percentage of pixels in each class or used saved values from another model run.

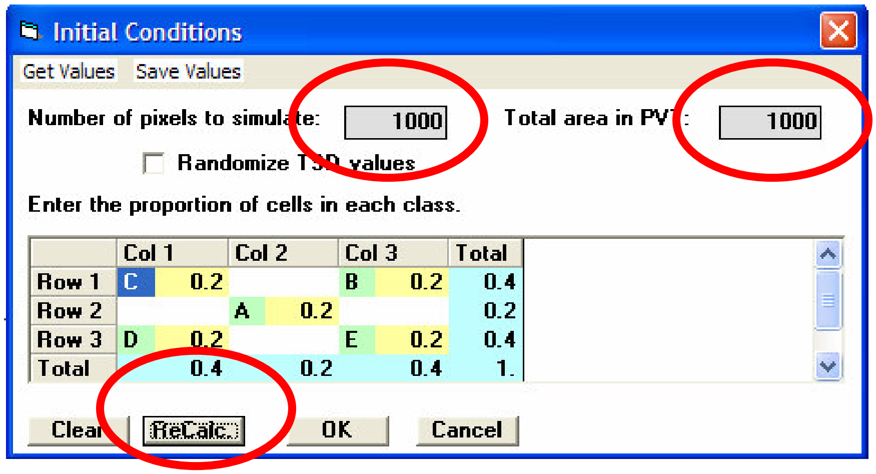


Figure 7.1: Edit Initial Conditions dialogue box

2. Set your TSD group (if applicable). If you have used TSD in any class, go to Run Model—Select TSD Group. Choose the disturbance group that you want VDDT to use when applying TSD. Generally, you will select AllFire.

3. Set your time definitions. Click Run Model—Time Definitions. Set the number of timesteps to 500. (If your PNVG is a slow system with long fire return intervals, you may choose to model 1000 timesteps). Set the number of times you wish to do this simulation to 10. (If you are modeling a system with slow succession or disturbance, you may need to model more than 500 years.)

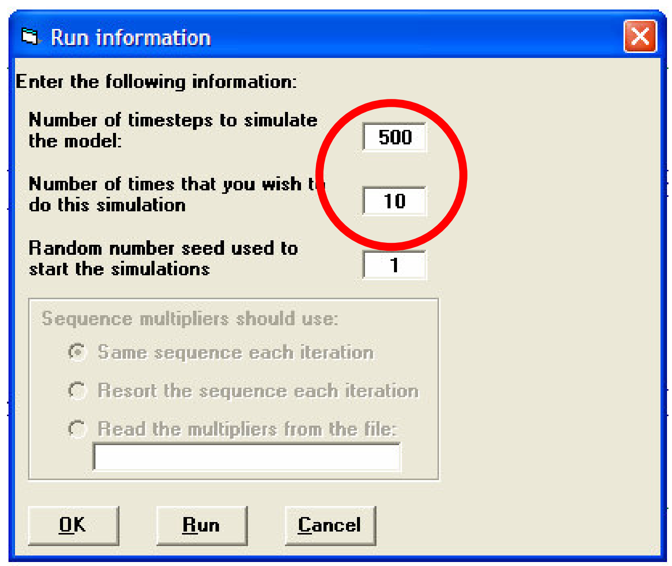


Figure 7.2: Time Definitions dialogue box.

4. Run the model. Select Run from the Time Definitions dialogue box OR from the Run Model menu.

Table 7.1: Quick Guide to Running a Model

Step	*Function*	*RA Model Guidelines*
1	*Edit Initial Conditions*	
	• Number of pixels to simulate………………	1000
	• Total area in PVT……………………………	1000
	• Percent of landscape in each class………..	Recalc
2	*Time Since Disturbance*	
	• Select TSD group……………………………	AllFire (when TSD used)
3	*Time Definitions*	
	• Number of timesteps to simulate…………..	500 (or 1000, depending on system)
	• Number of simulations………………………	10
4	*Run Model*……………………………………………	Select Run from Time Definitions dialogue box OR from the Run Model menu.

Viewing Results

1. Change the way data will be displayed under Results—Graph Options—
   - Same y-axis is a default and is checked on. Always leave this checked on.
   - Set graphing years at intervals you'd like to see in individual bar graphs (for example 0, 100, 300, 500).
   - Select Show avg, min, max. so that these are displayed
   - Select Show mean line and enter timesteps you'd like to see a VDDT to draw a meanline for (for example, 100 and 500).

2. To view the **percent of the landscape in each class**:
   A. Go to Results—View ending Conditions. The table shows the percent in each class at the end of your run. *OR*
   B. Go to Results—Bar—Class. The bar graph shows the percent of the landscape (y-axis) in each class (x-axis). *OR*
   C. Go to Results—Time—Class. Enter up to four classes to view. The line graphs show the percent of the landscape (y-axis) in each class (individual graphs) over time (x-axis).

To view the **probability of fire and other disturbances**:
   A. Go to Results—Time—Disturbance. Select up to four disturbances to view.
   B. The line graphs show the percent of the landscape (y-axis) that was affected by each disturbance (individual graphs) over time (x-axis).
   C. To convert the percent of the landscape affected by the disturbance (y-axis) to a probability, multiply the y-axis value by 0.01.

Always uncheck All Class Changes, or one of your four graphs will show the changes in all classes over time.

Double-Checking the Model

When the model results are acceptable, run the model again using ending values.

1. Go to Run Model—Edit Initial Conditions
2. Select Get Values—Use Ending Values. This will distribute the pixels into your 5 classes based on the ending values of your last model run. You can also use these values to estimate the percentages of each structure class.
3. Select Save Values—Current Values. The values file (.ic) should automatically save into the directory with the rest of your VDDT files. Be sure to name the .ic file with the unique code of the PNVG.
4. Go to Run Model—Run. This will be the final run of your model.

You may also want to test your model by turning fire off and seeing if the results are within your expectations.

1. Go to Run Model—Disable Some Disturbances.
2. Select AllFire (or any other disturbance you'd like to turn off).
3. Run the model again and view the results. Be sure to go back and turn fire back on before running the model a final time.

Chapter 8: Model Reporting and Documentation

Use the ModelTracker2.0 Database for model reporting and documentation. It is located on your workshop CD under RAModeling\ModelTracker2.0. Please complete a form in the database for every model as completely as possible.

About the Model Tracker Database

The model tracker database is an Access 2000 database. If you do not have Access 2000 or higher, please speak with the workshop facilitators.

Navigating in the database

- ❑ When you first open the database, a form called Rapid Assessment Reference Condition Models will open. You will enter all of the information here.
- ❑ The database consists of records (pages); each record contains the information for one of your PNVGs (they are blank until you enter the data).
- ❑ To navigate between PNVG records, use the arrows at the bottom of the window next to the word Record.
- ❑ Blue fields are automatically populated by the database.
- ❑ Green fields should match values in your VDDT model.
- ❑ Access will save the database as you work without your instruction. To save manually, simply click the save button (looks like a small floppy disk) on the tool bar.

Entering Information into the Database

- ❑ The information you enter into the database will become the description document for the PNVG. Thus, please be clear, concise, and use proper grammar, including complete sentences and correct spelling.
- ❑ Please cite sources in the longer description fields, as appropriate. Please list all references (not just those cited) at the end of the form.
- ❑ The information you enter into the database will be proofread and checked by the regional modeling lead and national LANDFIRE team members. Please make their job easier by being clear about your meaning.
- ❑ If you are uncertain about anything in the database, please ask. You can also log comments and concerns in the fields called Comments and Issues/Problems.
- ❑ The Key on the following pages explains each of the fields in the database.

Hints

- ⇨ Click View Report to see the formal, publishable summary of the information in your record.
- ⇨ The Title Bar at the bottom of the Access window (lower left) provides instructions for the field your cursor is currently in.

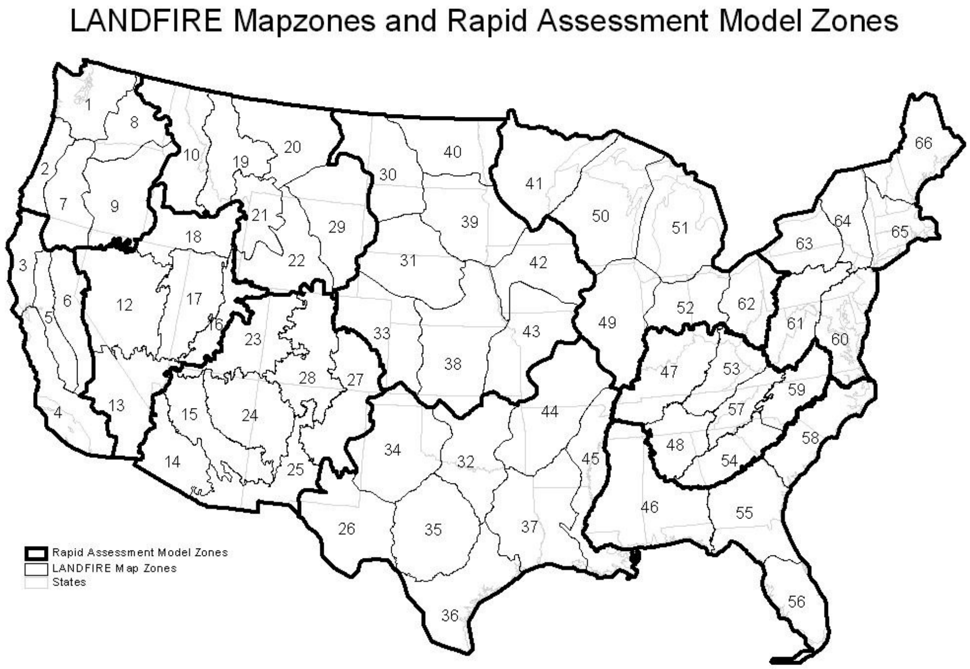
Key to Model Tracker Database Fields

General Information Section

Field Name	Instructions
Biophysical Setting Code	The RA team will assign you a 6-8 digit code after the PNVG (biophysical setting) list is developed. Codes follow this general format: ***R # SPSP ql*** Where: • *R* = R for Rapid Assessment • *#* = a numeric code for the model zone: *#* Pacific Northwest *0* Northern & Central Rockies *1* California *2* Great Basin *3* Southwest *4* Northern Plains *5* South Central *6* Great Lakes *7* Northeast *8* Southern Appalachians *9* Southeast • *SPSP* = the first two letters of each word in the dominant species. If there are more than one dominant species, common names will be used. • *ql* = lowercase alphabetical qualifier for biophysical or geographic constraints. Common qualifiers include: *an* ancient; *co* cool; *cw* cool-wet; *dy* dry; *ff* with frequent fire; *gr* grass; *if* with infrequent fire; *in* interior; *lw* lower; *mn* montane; *ms* mesic; *no* north; *pl* parkland *pu* pumice; *ri* riparian; *se* steppe; *so* south; *sp* serpentine; *st* with shrubs and trees; *up* upper; *wa* warm; *wd* warm dry; *we* wet; *wg* with grass; *ws* with shrub; *wt* with trees
Biophysical Setting Name	Enter the name of the PNVG (biophysical setting). This should be a descriptive title that includes the dominant species, region and qualifier. *Examples: Northern Rockies Dry Ponderosa Pine; Southwest Mixed Conifer Montane.*

Field Name	Instructions
Vegetation Type	Select the vegetation type (UNESCO world physiognomic classification) for your PNVG. You should base your selection on the *majority* of the landscape in the PNVG. They are defined as follows: • Forest: >5 m tall; 60-100% cover • Woodland: >5 m tall; 25-60% cover • Shrubland: 0.5-5 m tall; >25% cover (<25% cover of trees) • Grassland (herbaceous): >25% cover (<25% cover of trees and shrubs)
Dominant Species	Enter the NRCS Plants Code of at least one and up to eight dominant species for the PNVG. These should reflect the *majority* of the landscape in the PNVG and should be in order of dominance. If you don't know the NRCS Plants Code, you can search the NRCS Plants Database this way: 1. Click in a Dominant Species field. 2. Click on the Dominant Species button. A new window called NRCS Species Codes will open. 3. Put your cursor (click your mouse) in the box next to the name by which you'd like to search for the species, either Scientific Name or Common Name. 4. Click on the binoculars symbol. A new (called Find and Replace) window will open. 5. Type the name (scientific or common, depending on which you clicked earlier) of the plant in the Find What: box and select Find Next. The database will search for your species—it may take a while; there are over 82,000 plants! The code will be returned in the original NRCS Species Codes window. 6. When your species is found, select Exit with Code. The database will automatically input the code into the field where your cursor was. To search for another species, repeat the process.
Geographic Range	Describe the geographic distribution of this PNVG. Reference states, ecoregions, physiographic provinces, etc.
Biophysical Site Description	Describe the biophysical characteristics for this PNVG. This may include things like geographic distribution, elevation, aspect, soils, and slope.

Field Name	Instructions
Disturbance Description	Describe the dominant disturbances that impact this PNVG, including the agents, frequency, severity, and seasonality. Where applicable, describe the differential distribution of fire severity classes (e.g., "replacement fire typically occurs in classes B and E").
Vegetation Description	Describe the vegetation of this PNVG, including species, structure, and botanical characteristics.
Adjacency/ Identification Concerns	Enter information that may help identify the PNVG in the field, including: • synonomous local classifications (e.g., habitat type, plant association), • adjacent PNVGs, • PNVGs that this one may be confused with, • typical identifiers not described elsewhere, and • uncharacteristic types (i.e., patterns or processes that wouldn't have existed under the historic range of variability, like exotics) that may frequently occur in this PNVG today.
Scale Description	Describe the typical scale of the most common disturbance extent, the general minimum analysis area (e.g., the minimum size that would encompass the mosaic of this PNVG), and/or the average patch size. Cite any sources you used. Be clear about what scale you are describing.
Scale Source	Document the sources of information about scale. • <u>Literature</u>: that the values you entered came from published sources. • <u>Local data</u>: the values you entered came from local observations or records. • <u>Expert estimate</u>: the values you entered were estimated by you and/or others.
Issues/ Problems	Describe any difficulties, issues, or concerns you have about the model, the availability of data on this PNVG, or other considerations. Information from peer-reviews may be added to this field.
Modelers 1-3 and Email	Enter up to three modeler names and email addresses, in order of authorship. If there are additional authors, please list them in the *Comments* field.
Date	Enter the first day of the workshop you are attending. The date will be updated as peer review is incorporated.
Model Source	Document the sources of information you consulted for the model in general. Check all that apply: • <u>Literature</u>: the model generally came from published sources. • <u>Local data</u>: the model generally came from local research or information. • <u>Expert estimate</u>: the model was generally estimated by you and/or others.

Field Name	Instructions
Map Zone	Enter up to ten LANDFIRE map zones that this model applies to. Use the map below as necessary. 
Model Zone	Select only the Model Zone for which you are modeling. See the map above for the geography of your Model Zone. (This should also be implicit in the code for the PNVG.)
Comments & Suggested Reviewers	List suggested reviewers and document information from peer-reviews or workshop feedback. Use this field to capture any information that isn't captured elsewhere.

Vegetation Classes (A-E) Section

Field Name	**Instructions**
Class %	*These fields should match values in your VDDT model*. Enter the percent of the landscape in this class from the VDDT model. Round to the nearest 5% and double-check that the sum of all 5 classes is 100%.
Cover Type (e.g., Early, Mid, Late)	*These fields should match values in your VDDT model*. Cover types for class A-E default to the standard 5-box model (Table 1.2). If you changed cover types in the VDDT model, change them here.
Structure Class (e.g., All, Open, Closed)	*These fields should match values in your VDDT model*. Structure classes for class A-E default to the standard 5-box model (Table 1.2). If you changed structure classes in the VDDT model, change them here.
Description	Describe the structure, composition, and other attributes for each class.
Dominant Species	Enter the NRCS Plants Code of up to four dominant species for the vegetation class, in order of dominance. If you don't know the NRCS Plants Code, you can search the NRCS Plants Database as described above, under *General Information, Dominant Species.*
Dominant Species Canopy Position	Enter the relative position of each dominant species in the canopy. If a dominant species is listed as "Upper" it should be included in the structure estimates for the Upper Layer Lifeform (see below). Options for canopy position are: • *Upper*: upper-most portion of the canopy; dominant or emergent. • *Mid-Upper*: ranging from middle to upper portions of the canopy; co-dominant. • *Middle*: middle section of the canopy; co-dominant or intermediate. • *Lower-Mid*: ranging from the lower to the middle portions of the canopy; intermediate or suppressed. • *Lower*: below the main canopy; may be suppressed or understory. • *All*: can vary between any canopy position, or occupies all levels of the canopy.

Field Name	Instructions
Fuel Model	Enter the Anderson Fuel Model for the class, if known. Fuel models are:

#	*Vegetation Type*	*Fuels*
1	Perennial grasslands, annual grasslands, savannahs, grass-tundra, grass-shrub with < 1/3 shrub or timber	Cured fine, porous herbaceous; .5-.9 tons surface fuel load per acre; .5-2 foot depth
2	Shrub, pine, oak, pinyon-juniper with < 2/3 shrub or timber cover	Fine herbaceous surface cured or dead, litter, dead stem or limb wood; 1-4 tons surface fuel load per acre; .5-2 foot depth
3	Tall grassland, prairie, and Meadow	Tall herbaceous surface with > 1/3 dead or cured; 2-4 tons fuel load per acre; 2-3 foot depth
4	Coastal/Sierra chaparral, pocosin shrub (fetterbrush, gallberry, bays), southern rough shrub, closed jack pine, pine barrens	Flammable foliage and small dead woody material with or w/o litter layer; 10-15 tons fuel load per acre; 4-8 foot depth
5	Moist or cool shrub types (laurel, vine maple, alder, manzanita, chamise), forest/shrub, regeneration shrubfields after fire or harvest	Green foliage with or w/o litter; 3-5 tons per acre; 1-3 foot depth
6	Pinyon-juniper w/ shrubs, southern hardwood/ shrub w/ pine, frost killed gambel oak, pocosin shrub, chamise, chaparral, spruce-taiga, shrub-tundra, hardwood slash	Flammable foliage, but shorter and more open than FM 4 w/ less dead small wood and litter; 4-8 tons per acre; 2-4 foot depth
7	Palmetto-gallberry w/ or w/o pine overstory, black spruce/shrub, southern rough, slash pine/gallberry	Flammable foliage even when green; 4-6 tons per acre; 2-3 foot depth
8	Closed canopy short needle conifer types, closed canopy broadleaf or hardwood types	Usually low to moderately flammable foliage with litter or scattered vegetation understory; 4-6 tons per acre surface fuels; .1-.5 foot depth
9	Long needle (ponderosa, Jeffrey, red, southern) conifer types, oak-hickory and similar hardwood types	Flammable foliage with needle or leaf litter and some dead down woody material; 3-4 tons per acre; .1-.5 feet
10	Any Forest type with > 3" down dead woody fuels)	Dead down > 3" woody fuels and litter; 10-14 tons per acre of total surface fuel < 3"; .5-2 foot depth
11	Light logging slash, partial cut slash	10-14 tons per acre total fuel load < 3"; .5-2 foot depth
12	Moderate and continuous logging slash in clearcuts or heavy partial cuts and thinned areas	30-40 tons per acre total fuel load < 3"; 2-3 foot depth
13	Heavy and continuous logging slash in clearcuts or heavy partial cuts and thinned areas	50-60 tons per acre total fuel load > 3"; 2-4 foot depth

Upper Layer Lifeform	Select either tree, shrub, or herbaceous for the upper layer lifeform of the class. Select only one. If it is difficult to select one, also provide a description in the description field.

<table>
<tr><th>Field Name</th><th>Instructions</th></tr>
<tr><td>Minimum and Maximum Canopy Closure</td><td>Enter the minimum and maximum canopy closure expected for the upper layer lifeform of each class. This is required when the difference between types (e.g., open/closed) is defined by canopy cover.</td></tr>
<tr><td>Minimum and Maximum Height</td><td>Enter the minimum and maximum height for the upper layer lifeform. The height selected should be a class related to the Upper Layer Lifeform selected above. Height classes are:
<table>
<tr><td colspan="2">Trees</td><td colspan="2">Shrubs</td><td colspan="2">Herbaceous</td></tr>
<tr><td>Regen-eration</td><td><5 m (~<16 ft)</td><td>Dwarf</td><td><0.5m (~<1.6 ft)</td><td>Short</td><td><0.5m (~<1.6 ft)</td></tr>
<tr><td>Short</td><td>5-9 m (~16-30 ft)</td><td>Short</td><td>05.-0.9m (~1.6-3 ft)</td><td>Medium</td><td>0.5-0.9m (~1.6-3 ft)</td></tr>
<tr><td>Medium</td><td>10-24 m (~30-78 ft)</td><td>Medium</td><td>1-2.9m (~3-9.5 ft)</td><td>Tall</td><td>>1m (~3-9.5 ft)</td></tr>
<tr><td>Tall</td><td>24-49 m (~78-160 ft)</td><td>Tall</td><td>>3m (~>9.5 ft)</td><td></td><td></td></tr>
<tr><td>Giant</td><td>>50 m (~>160 ft)</td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Tree Size Class</td><td>Only if the upper layer lifeform is tree, select the maximum tree size class. If the size class ranges widely, describe it in the class description field. Size classes are:
<table>
<tr><td>Seedling</td><td><4.5 ft tall (~<1.4 m)</td></tr>
<tr><td>Sapling</td><td>>4.5 ft tall; <5” DBH (~>1.4m tall; ~<13 cm DBH)</td></tr>
<tr><td>Pole</td><td>5-9” DBH (~13-23 cm DBH)</td></tr>
<tr><td>Medium</td><td>9-21” DBH (~23-53 cm DBH)</td></tr>
<tr><td>Large</td><td>21-33” DBH (~53-84 cm DBH)</td></tr>
<tr><td>Very Large</td><td>>33” DBH (~>84 cm DBH)</td></tr>
</table></td></tr>
<tr><td>Upper layer is different from dominant lifeform</td><td>If the upper layer lifeform is different from the dominant lifeform (e.g., in a savanna type system), check this box and describe the canopy cover range and height for the dominant lifeform.</td></tr>
<tr><td>Total</td><td>This value is automatically calculated. Please ensure that this value equals 100%.</td></tr>
</table>

Disturbances Section

Field Name	Instructions
Fire Regime Group	Select the single *dominant* Fire Regime Group. If the PNVG doesn't fit into a single Fire Regime Group, select the closest option and explain the fire regime in more depth in the Disturbance Description field above. • FRG I = 0-35 year frequency; low severity • FRG II = 0-35 year frequency; replacement severity • FRG III = 35-100+ year frequency; mixed severity • FRG IV = 35-100+ year frequency; replacement severity • FRG V = 200+ year frequency; replacement severity
Fire Regime Sources	Indicate the sources for your information about fire intervals: • <u>Literature</u>: that the values you entered came from published sources. • <u>Local data</u>: the values you entered came from local observations or records. • <u>Expert estimate</u>: the values you entered were estimated by you and/or others.
Average Fire Interval (Frequency)	*This field should match values in your VDDT model.* For each severity class (Replacement, Mixed Severity, Surface), enter the average (or other central tendency) fire interval in years, as used in the VDDT model. Fire interval is defined as the number of years between fires.
Minimum Fire Interval (Frequency)	For each severity class (Replacement, Mixed Severity, Surface), enter the minimum fire interval (smallest number) in years. This is not the statistical minimum and is for informational purposes. It is not derived from the VDDT model.
Maximum Fire Interval (Frequency)	For each severity class (Replacement, Mixed Severity, Surface), enter the maximum fire interval (largest number) in years. This is not the statistical maximum and is for informational purposes. It is not derived from the VDDT model.
Probability	*This value is automatically calculated.* Probability is equal to 1/Average Frequency. It should closely mirror the probability of fire in the model.
Percent all fires	*This value is automatically calculated.* Percent all fires is equal to probability of severity class/ All Fire Probability.
All Fire Frequency	*This value is automatically calculated.* All Fire Frequency is equal to 1/ All Fire Probability. It should reflect the AllFire frequency in the model.
All Fire Probability	*This value is automatically calculated.* All Fire Probability will be automatically calculated by the database and is equal to the sum of probabilities for the three severity classes.
Historical Fire Size	Enter the average, minimum, and maximum historical (natural) fire size in acres, to the best of your ability. Round values as necessary. This value will be used to help inform LANDSUM modeling.

Field Name	Instructions
Non-Fire Disturbances	Check all of the other disturbances you used in the model. Describe their frequencies in the Disturbance Description box under General Information. If you used an "optional" disturbance in the model, be sure to define it here.

References Section

Field Name	Instructions
References Cited	Cite all of the references you used while creating this model. They should be listed in alphabetical order (you may want to type these in a word processing program and copy them here to catch spelling mistakes and sort alphabetically). Follow these formats: *Journal Articles* Last, First, [additional authors Last, First,] and Last, First. Year. Title. Journal: Volume (Issue): page-page. *Books and Book Sections* Last, First, [additional authors Last, First,] and Last, First. Year. Title. [In Last, First, ed. Book Title.] City: Publisher. Pages. *Government Publications* Last, First, [Additional authors Last, First,] and Last, First. Year. Title. Publication type and number. City, State: Agency. Pages. *Online Sources* Try to mimic the above citations. Include date accessed at the end of the citation. When referencing FEIS, please follow their citation guide, listed under *Authorship and Citation* in the first section of each species description.

Chapter 9: Peer Review Process

Rapid Assessment, FRCC, and LANDFIRE models should represent the best available science based on literature, data, and local expertise. To ensure that these models synthesize the best available knowledge to-date, the peer review process is critical.

Rapid Assessment models will be peer reviewed in two structured phases:

1. **In-Workshop Review.** Three to four models will be presented during the workshop. In-workshop review will be structured to share and learn modeling techniques, correct unintended errors, provide feedback on ecology, and collectively work on particularly difficult or important models. In-workshop review will be structured as follows:

   - ❑ Modelers will have 10-15 minutes to present their model.
   - ❑ Reviewers (other workshop participants) will have 10-15 minutes to engage in discussion and provide peer review during the workshop.
   - ❑ Modelers will incorporate the comments and suggestions arising from the in-workshop peer review into the model and/or the model documentation.

2. **External Review.** Each model will be reviewed by voluntary reviewers after the workshop. Some reviewers will have attended the workshop and some will not. External reviewers may chose to review only the description or the description and the VDDT model . They will respond to a structured set of questions (Appendix H). Changes, suggestions, and comments from the external review will be incorporated into the model and/or documentation.

Appendix A: Links and Additional Resources

This table highlights links to LANDFIRE and related projects and resources for modelers.

LANDFIRE www.landfire.gov	The LANDFIRE website, explaining the project's scope, objectives, and deliverables.
FRCC Guidebook (Fire Regime Condition Class) www.frcc.gov	The Fire Regime Condition Class (FRCC) website, which includes explanations of the project, the entire guidebook, and descriptions of PNVGs modeled to-date.
VDDT (Vegetation Dynamics Development Tool) www.essa.com	The website for ESSA, the company that created VDDT. VDDT is public domain and can be downloaded from the web. User's guides, updates, and other software packages are available here.
The Coarse-Scale Spatial Data www.fs.fed.us/fire/fuelman	*The Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management* (Schmidt et al. 2002, USDA Forest Service General Technical Report RMRS-87) started it all. This document was the pre-cursor to FRCC and LANDFIRE and was a first, coarse-scale attempt at mapping fire regime characteristics, including FRCC, for the entire US.
The National Fire Plan www.fireplan.gov	LANDFIRE is part of the implementation of the National Fire Plan, an interagency commitment to the rehabilitation and restoration of fire-adapted ecosystems, among other goals.
The Nature Conservancy's Global Fire Initiative http://nature.org\initiatives\fire	The Nature Conservancy's Fire Initiative was designed to address the threat of altered fire regimes on both public and private lands. TNC is taking a leading role in the development of succession models, PNVG refinement, and mapping current cover types in the LANDFIRE project.
The Missoula Fire Sciences Laboratory www.firelab.org	The Fire Lab, a division of the USDA Forest Service Rocky Mountain Research Station, is the scientific and methodlogical leader in the LANDFIRE project.
EROS Data Center http://edc.usgs.gov	USGS's Earth Resources Observation System (EROS) Data Center leads the vegetation data collection in LANDFIRE.
FEIS: Fire Effects Information System www.fs.fed.us/database/feis	FEIS is a searchable database containing summaries of fire effects, fire ecology, and botanical characteristics of species in North America. Summaries are updated regularly and provide excellent baseline information and literature reviews.
Wildland Fire in Ecosystems: Effects of Fire on Flora www.fs.fed.us/rm/pubs/rmrs_gtr42_2.html	This publication is part of the Rainbow Series and contains regional summaries of fire history and effects for ecological systems in the United States. It provides broad information and literature reviews.

Appendix B: Letters of Support from Federal Land Management Agencies

File Code: 5100 **Date:** July 29, 2004
Route To: (2400), (4000), (5100)

Subject: Introduction of Interagency Fire, Ecosystem, and Fuel Assessment Mapping Project, LANDFIRE

To: Regional Foresters, Station Directors, Area Director, IITF Director, and WO Staff

LANDFIRE is a five-year, $40 million interagency partnership sponsored by the Wildland Fire Leadership Council involving the Forest Service, the Department of the Interior, including the Bureau of Land Management, National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs, and U.S. Geological Survey. The Nature Conservancy is also a major partner and several other agencies are making contributions as well.

The LANDFIRE project integrates reference data, satellite imagery, and models of fire and vegetation dynamics. LANDFIRE will generate nationally consistent, mid-scale maps and digital geospatial data of vegetation characteristics and condition, fire behavior and effects, fuels models, historical fire regimes, and fire regime condition class at the landscape level.

The success of LANDFIRE is considered critical to the National Fire Plan, the Healthy Forests Initiative, and implementation of the Healthy Forests Restoration Act. It will help land managers identify priority areas for reduction of wildfire risks and to identify and facilitate restoration of forest, shrub, and grass ecosystems.

At the heart of LANDFIRE lies a reference database containing geo-referenced field data describing vegetation, fire, and fuels. The project relies heavily upon existing inventory, monitoring, and research programs for these data. Assistance from field units and managers is critical to ensure that the best data and science are incorporated into the LANDFIRE project.

Thank you for your efforts in supporting the LANDFIRE project. If you would like to learn more about LANDFIRE, please visit www.landfire.gov.

/s/ Sally Collins (for)
DALE N. BOSWORTH
Chief

cc: fire directors

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Washington, D.C. 20240

July 30, 2004

In Reply Refer To:
9211 (FA100) I

EMS TRANSMISSION 08/05/2004
Information Bulletin No. 2004-127

To: AFOs
Attn: State Fire Management Officers

From: Director

Subject: Status of Interagency LANDFIRE Project

LANDFIRE is a five-year, $40 million interagency partnership sponsored by the Wildland Fire Leadership Council involving the Forest Service and the Department of the Interior, including the Bureau of Land Management, National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs, and U.S. Geological Survey. The Nature Conservancy plays an important role, and other federal and state research institutions also contribute.

The purpose of LANDFIRE is to generate the nationally consistent spatial data and predictive models needed by land and fire managers to prioritize, evaluate, plan, complete and monitor fuel treatment and restoration projects, and can be applied to decision making for wildland fire management. The success of this project is essential for achieving the goals of the National Fire Plan, Healthy Forests Initiative and implementation of the Healthy Forests Restoration Act.

The LANDFIRE project integrates satellite imagery, models of fire and vegetation dynamics, and field data. Products will include landscape scale maps and digital geo-spatial data of existing vegetation, biophysical settings, current fuel loadings, historical fire regimes and Fire Regime Condition Class (indices of departure from historical fire regimes). These products are ideal for regional planning and can be stepped down to complement finer scale mapping efforts and assist local planning.

Potential applications of the LANDFIRE deliverables include improved risk assessments, fire behavior predictions, treatment prioritization and integration with Land Health Standards. Land Use Plans, Fire Management Plans and project plans can all benefit from these products. In summary, LANDFIRE data layers will augment and strengthen local information for a wide range of fire and fuels applications.

A fundamental element of LANDFIRE is a database containing geo-referenced field data describing vegetation and fuels. The project relies heavily upon data from existing inventory, monitoring and research projects. Assistance from knowledgeable staff at LANDFIRE workshops is critical to ensure that the best data and science are incorporated into the project. This participation will ensure that Bureau lands are accurately represented in the final mapping and data layers.

Thank you for your efforts in supporting LANDFIRE. If you would like to learn more about LANDFIRE, please visit www.landfire.gov or contact Melanie Miller, Planning and Resources (FA-620) at 406-829-6941.

Signed by:
Francis R. Cherry, Jr.
Acting Director

Authenticated by:
Barbara J. Brown
Policy & Records Group, WO-560

In Reply Refer To:
FWS/ANRS-NR-FM/018582

Memorandum

To: Regional Directors, Regions 1-7
Manager, California/Nevada Operations Office
Refuge Chiefs, Regions 1-7 and CNO

From: Assistant Director - National Wildlife Refuge System
/s/ William Hartwig August 31, 2004

Subject: LANDFIRE

LANDFIRE is a five-year, $40 million interagency partnership sponsored by the Wildland Fire Leadership Council involving the Department of the Interior (including the Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and U.S. Geological Survey) and the USDA Forest Service. The Nature Conservancy is also a major partner and several other agencies are making contributions as well.

The LANDFIRE project integrates reference data, satellite imagery, and models of fire and vegetation dynamics. Nationally LANDFIRE will generate consistent, mid-scale maps and digital geospatial data of vegetation characteristics and conditions, fire behavior and effects, fuels models, historical fire regimes, and fire regime condition class at the landscape level.

The success of LANDFIRE is considered critical to the National Fire Plan, the Healthy Forests Initiative, and implementation of the Healthy Forests Restoration Act. It will help land managers identify priority areas for reduction of wildfire risks and to identify and facilitate restoration of forest, shrub, and grass ecosystems.

At the heart of LANDFIRE lies a reference database containing geo-referenced field data describing vegetation, fire, and fuels. The Service's fire program, as well as many natural resource programs, should find this database very valuable for planning and incident management. In addition to vegetation and biophysical data layers at a 30-meter resolution, the database will contain spatial and 18 years of daily weather data necessary for running the FARSITE program (Fire Area Growth Simulation Model).

LANDFIRE relies on a reference database containing geo-referenced field data describing vegetation, fire, and fuels. The project relies heavily upon existing inventory, monitoring, and research programs for this data. Assistance from field units and managers is critical to ensure that the best data and science are incorporated into the LANDFIRE project. The LANDFIRE project will also need knowledgeable staff at LANDFIRE vegetative modeling workshops, and support of LANDFIRE field sampling crews. This participation will ensure accurate representation of your area in the final products.

Thank you for your efforts in supporting the LANDFIRE project. If you would like to learn more about LANDFIRE, please visit www.landfire.gov.

Cc: 3251-MIB-FWS/ANRS
670-ARLSQ-FWS/ANRS-DNRS
670-ARLSQ-FWS/ANRS-OIM
570-ARLSQ-FWS/ANRS-NR
570-ARLSQ-FWS/ANRS-NR-FM
Regional Fire Management Coordinators 1-7 & CNO

FWS/ANRS-NR-FM:BLeenhouts:kem:8/24/04:703-358-2043
S:\Control Correspondence\2004\018582.doc

Appendix C: Rapid Assessment Workshops Information Bulletin

LANDFIRE Rapid Assessment Workshops: Schedule, Contact, and Background Information

Rapid Assessment reference condition modeling workshops will be held across the United States in each of the broad regions shown below. Workshops engage vegetation and disturbance ecology experts to model vegetation dynamics, map natural vegetation, and transfer information about the LANDFIRE project. To get on a mailing list for your region, contact the appropriate regional lead below. See reverse for more information about LANDFIRE, the Rapid Assessment, and workshops.

Workshop Regions, Dates, and Contact Information

About LANDFIRE

LANDFIRE is a 5-year, multi-partner wildland fire, ecosystem, and fuel assessment-mapping project that will generate consistent, comprehensive, landscape-scale maps and data of vegetation, fire, and fuel characteristics in the United States. It meets agency and partner needs for data to support fire management planning, prioritization of fuel treatments, collaboration, community and firefighter protection, and effective resource allocation. For more information, see www.landfire.gov.

About the Rapid Assessment

LANDFIRE includes a mid-scale ***Rapid Assessment*** of Fire Regime Condition Class (FRCC), a measure of the departure of current vegetation, fuel, and fire regime conditions from reference conditions. The national Rapid Assessment FRCC map will be completed in the summer of 2005 and will be used for regional to national strategic planning, broad ecological assessments, and resource allocation. It is designed to fill data needs until the entire suite of LANDFIRE products is available.

About Reference Condition Modeling Workshops

Reference condition modeling workshops have three primary ***objectives***:

1. Refine the list of potential natural vegetation groups (PNVGs) for the region and model reference conditions (pre-EuroAmerican settlement) for every PNVG using quantitative state and transition models. There are 20-50 PNVGs in each region.
2. Develop spatial rules for mapping every PNVG and assign current cover types to each.
3. Transfer information to experts and managers about LANDFIRE, and provide feedback to the LANDFIRE technical team about local concerns.

Reference Condition models developed during Rapid Assessment workshops ***will be used for***:

- ♦ Mapping FRCC for the national Rapid Assessment, which will affect national strategic planning, broad ecological assessments, and resource allocation.
- ♦ Project-scale FRCC assessments using the FRCC Guidebook methodology (www.frcc.gov). Rapid Assessment models will supplement and/or replace existing FRCC Guidebook reference conditions.
- ♦ First-draft LANDFIRE reference condition models. Refinement of Rapid Assessment reference condition models for finer resolution LANDFIRE products will continue through 2009.

Workshop participants are trained in a quantitative state and transition modeling software called VDDT (Vegetation Dynamics Development Tool). The ***intended workshop audience*** includes:

- Experts in fire, vegetation, and disturbance ecology;
- Interagency, academic, and non-governmental land managers, researchers, and field experts;
- Experts with field experience and strong geographical knowledge of the region;
- Experts willing to commit to participating in a week-long workshop (in the Western US) or a 3-day workshop (in the Eastern US), and/or experts interested in providing post-workshop review of reference condition models.

Invitations and announcements will be sent individually for regional workshops. For more information or to get on a mailing list, see regional contact information above or contact the national staff below.

National Rapid Assessment Staff

Jim Menakis	**Ayn Shlisky**	**Kelly Pohl**
US Forest Service	The Nature Conservancy	The Nature Conservancy
jmenakis@fs.fed.us, 406-329-4958	ashlisky@tnc.org, 720-974-7063	kpohl@tnc.org, 720-974-7059

Appendix D: Cross-Walk of FRCC, Coarse-Scale, and Kuchler PNVGs

Western US (as of October 2004)

FRCC		Coarse Scale		Kuchler	
AAOW	Alder - ash (OR, WA)	21	Alder-ash (WA, OR)	25	ALDER-ASH
AGRA1	Calif. Annual Grassland	30	Annual grassland	48	CALIFORNIA STEPPE
AGRA2	Calif. Annual Grassland With Shrubs	30	Annual grassland	48	CALIFORNIA STEPPE
AMDW	Alpine Meadows_Barren	37	Alpine meadows-barren	52	ALPINE MEADOWS AND BARREN
BSAG1	Sagebrush-Basin Big	25	Sagebrush	38	GREAT BASIN SAGEBRUSH
				55	SAGEBRUSH STEPPE
				56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
BSAG2	Sagebrush-Basin Big, With Trees	25	Sagebrush	38	GREAT BASIN SAGEBRUSH
				55	SAGEBRUSH STEPPE
				56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
CAME	California mixed evergreen	18	California mixed evergreen	29	CALIFORNIA MIXED EVERGREEN
CAST1	Calif. Steppe Grassland	30	Annual grassland	48	CALIFORNIA STEPPE
CAST2	Calif. Steppe With Shrubs/Trees	30	Annual grassland	48	CALIFORNIA STEPPE
CHAP1	Chaparral-Xeric (Coastal California)	26	Chaparral	33	CHAPARRAL
				35	COASTAL SAGEBRUSH
				36	Mosaic of CALIFORNIA OAKWOODS and COASTAL SAGEBRUSH
CHAP2	Chaparral-Mesic (Coastal California)	26	Chaparral	33	CHAPARRAL
				35	COASTAL SAGEBRUSH
				36	Mosaic of CALIFORNIA OAKWOODS and COASTAL SAGEBRUSH
CHAP4	Chaparral - Montane (Cascades-Sierras)	26	Chaparral	31	OAK-JUNIPER
				32	Transition between OAK-JUNIPER and MOUNTAIN MAHOGANY-OAK
				33	CHAPARRAL
				34	MONTANE CHAPARRAL
				37	MOUNTAIN MAHOGANY-OAK

FRCC		Coarse Scale		Kuchler	
CHAP5	Chaparral - Interior West	26	Chaparral	31	OAK-JUNIPER
				32	Transition between OAK-JUNIPER and MOUNTAIN MAHOGANY-OAK
				37	MOUNTAIN MAHOGANY-OAK
CHDF	Cedar - Hemlock - Douglas fir_Coast	13	Cedar-hemlock-Douglas-fir	2	CEDAR-HEMLOCK-DOUGLAS FIR
CHDO	Mosaic Cedar - Hemlock - Douglas fir & Oak (OR)	20	Mosaic cedar-hemlock-Dokuglas-fir and oak (OR)	28	Mosaic of CEDAR-HEMLOCK-DOUGLAS FIR and OREGON OAKWOODS
CHPI	Cedar - Hemlock - Pine (WA)	12	Cedar-hemlock-pine (WA)	13	CEDAR-HEMLOCK-PINE
CSAG1	Sagebrush-Cool	71	Cool Sagebrush	38	GREAT BASIN SAGEBRUSH
				55	SAGEBRUSH STEPPE
				56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
CSAG2	Sagebrush-Cool, With Trees	71	Cool Sagebrush	38	GREAT BASIN SAGEBRUSH
				55	SAGEBRUSH STEPPE
				56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
DFIR1	Douglas fir (Interior PNW)	4	Douglas-fir	12	DOUGLAS FIR
DFIR2	Douglas fir (Interior Rockies)	4	Douglas-fir	12	DOUGLAS FIR
DGRA1	Desert Grassland	34	Desert grassland	53	GRAMA-GALLETA STEPPE
				54	GRAMA-TOBOSA PRAIRIE
DGRA2	Desert Grassland With Trees	34	Desert grassland	53	GRAMA-GALLETA STEPPE
				54	GRAMA-TOBOSA PRAIRIE
DGRA3	Desert Grassland With Shrubs	34	Desert grassland	53	GRAMA-GALLETA STEPPE
				54	GRAMA-TOBOSA PRAIRIE
DSHB1	Desert Shrub-Salt Desert Shrub	28	Desert shrub	40	SALTBUSH-GREASEWOOD
DSHB2	Desert Shrubland With Grasses	28	Desert shrub	39	BLACKBRUSH
				44	CREOSOTE BUSH-TARBUSH
				57	GALLETA-THREE AWN SHRUBSTEPPE
				58	GRAMA-TOBOSA SHRUBSTEPPE
DSHB3	Desert Shrubland With Trees	28	Desert shrub	39	BLACKBRUSH

FRCC		Coarse Scale		Kuchler	
				44	CREOSOTE BUSH-TARBUSH
DSHB3	Desert Shrubland With Trees	28	Desert shrub	57	GALLETA-THREE AWN SHRUBSTEPPE
				58	GRAMA-TOBOSA SHRUBSTEPPE
DSHB4	Desert Shrubland	28	Desert shrub	41	CREOSOTE BUSH
				42	CREOSOTE BUSH-BUR SAGE
				43	PALO VERDE-CACTUS SHRUB
				46	Desert: vegetation largely absent
FHWO1	Fir-Hemlock (WA, OR)_Forest	15	Fir-hemlock (WA, OR)	4	FIR-HEMLOCK
FHWO2	Fir-Hemlock (WA, OR)_Parkland	15	Fir-hemlock (WA, OR)	4	FIR-HEMLOCK
GBPI	Great Basin Pine (NV, UT)	2	Great Basin pine (NV, UT)	22	GREAT BASIN PINE
GFDF	Grand Fir-Douglas fir	7	Grand fir-Douglas-fir	14	GRAND FIR-DOUGLAS FIR
JUPI1	Juniper - Pinyon - Frequent	22	Juniper-pinyon	23	JUNIPER-PINYON
JUPI2	Juniper - Pinyon - Rare	22	Juniper-pinyon	23	JUNIPER-PINYON
JUST1	Juniper Steppe - Infrequent	23	Juniper steppe	24	JUNIPER STEPPE
JUST2	Juniper Steppe-Ancient	23	Juniper steppe	24	JUNIPER STEPPE
LPSC	Lodgepole pine - Subalpine (CA)	17	Lodgepole pine-Subalpine (CA)	8	LODGEPOLE PINE
MBNM	Mesquite bosques (NM)	24	Mesquite Bosques (NM)	27	MESQUITE BOSQUES
MCAN	SW Mixed Conifer (AZ, NM)	10	SW mixed conifer (AZ, NM)	19	ARIZONA PINE
				20	SPRUCE-FIR-DOUGLAS FIR
				21	SOUTHWESTERN SPRUCE-FIR
MCON	California Mixed Conifer	5	Mixed conifer	5	MIXED CONIFER
MGRA1	Mountain Grassland	31	Fescue-wheatgrass	47	FESCUE-OATGRASS
				50	FESCUE-WHEATGRASS
				51	WHEATGRASS-BLUEGRASS
				63	FOOTHILLS PRAIRIE
MGRA2	Mountain Grassland With Trees	31	Fescue-wheatgrass	47	FESCUE-OATGRASS
				50	FESCUE-WHEATGRASS
MGRA2	Mountain Grassland With Trees	31	Fescue-wheatgrass	51	WHEATGRASS-BLUEGRASS
				63	FOOTHILLS PRAIRIE
MGRA3	Mountain Grassland With Shrubs	31	Fescue-wheatgrass	47	FESCUE-OATGRASS

FRCC		Coarse Scale		Kuchler	
				50	FESCUE-WHEATGRASS
				51	WHEATGRASS-BLUEGRASS
		31	Fescue-wheatgrass	63	FOOTHILLS PRAIRIE
MSHB1	Mountain Shrubland With Trees	26	Chaparral	31	OAK-JUNIPER
				32	Transition between OAK-JUNIPER and MOUNTAIN MAHOGANY-OAK
				33	CHAPARRAL
				37	MOUNTAIN MAHOGANY-OAK
MSHB2	Mountain Shrubland	26	Chaparral	31	OAK-JUNIPER
				32	Transition between OAK-JUNIPER and MOUNTAIN MAHOGANY-OAK
				33	CHAPARRAL
MSHB2	Mountain Shrubland	26	Chaparral	37	MOUNTAIN MAHOGANY-OAK
OCWI	Oak and Conifer Woodlands Interior Southwest	26	Chaparral	31	OAK-JUNIPER
				32	Transition between OAK-JUNIPER and MOUNTAIN MAHOGANY-OAK
				37	MOUNTAIN MAHOGANY-OAK
OKCA1	Oakwoods(Calif)-Blue Oak	19	Oakwoods (CA)	30	CALIFORNIA OAKWOODS
OKCA2	Oakwoods (Calif)-Garry Oak	19	Oakwoods (CA)	26	OREGON OAKWOODS
				30	CALIFORNIA OAKWOODS
PGRA1	Northern Plains Grassland	32	Plains grassland	64	GRAMA-NEEDLEGRASS-WHEATGRASS
				66	WHEATGRASS-NEEDLEGRASS
				67	WHEATGRASS-BLUESTEM-NEEDLEGRASS
				68	WHEATGRASS-GRAMA-BUFFALO GRASS
				69	BLUESTEM-GRAMA PRAIRIE
PGRA2	N. Plains Grassland With Trees	32	Plains grassland	64	GRAMA-NEEDLEGRASS-WHEATGRASS
				66	WHEATGRASS-NEEDLEGRASS
				67	WHEATGRASS-BLUESTEM-NEEDLEGRASS

FRCC		Coarse Scale		Kuchler	
				68	WHEATGRASS-GRAMA-BUFFALO GRASS
PGRA2	N. Plains Grassland With Trees	32	Plains grassland	69	BLUESTEM-GRAMA PRAIRIE
PGRA3	N. Plains Grassland With Shrubs	32	Plains grassland	64	GRAMA-NEEDLEGRASS-WHEATGRASS
				66	WHEATGRASS-NEEDLEGRASS
				67	WHEATGRASS-BLUESTEM-NEEDLEGRASS
				68	WHEATGRASS-GRAMA-BUFFALO GRASS
				69	BLUESTEM-GRAMA PRAIRIE
PGRA4	Southern Plains Grassland	32	Plains grassland	65	GRAMA-BUFFALOGRASS
				66	WHEATGRASS-NEEDLEGRASS
				67	WHEATGRASS-BLUESTEM-NEEDLEGRASS
				68	WHEATGRASS-GRAMA-BUFFALO GRASS
				69	BLUESTEM-GRAMA PRAIRIE
PGRA5	S. Plains Grassland With Trees	32	Plains grassland	65	GRAMA-BUFFALOGRASS
				69	BLUESTEM-GRAMA PRAIRIE
PGRA6	S. Plains Grassland With Shrubs	32	Plains grassland	65	GRAMA-BUFFALOGRASS
				69	BLUESTEM-GRAMA PRAIRIE
POAK	Plains Oaks/Shinnery	29	Shinnery	71	SHINNERY
PPDF1	Pine - Douglas fir-Inland NW	3	Pine-Douglas-fir	11	WESTERN PONDEROSA PINE
PPDF3	Pine - Douglas fir-Central Rocky Mts	3	Pine-Douglas-fir	11	WESTERN PONDEROSA PINE
				16	EASTERN PONDEROSA
				18	PINE-DOUGLAS FIR
PPDF5	Pine - Douglas fir-Colorado Plateau	3	Pine-Douglas-fir	11	WESTERN PONDEROSA PINE
				18	PINE-DOUGLAS FIR
				19	ARIZONA PINE
PPDF6	Pine - Douglas fir-Southern Rocky Mts	3	Pine-Douglas-fir	18	PINE-DOUGLAS FIR
PPDF7	Pine - Douglas fir-Southwest	3	Pine-Douglas-fir	18	PINE-DOUGLAS FIR
				19	ARIZONA PINE

FRCC		Coarse Scale		Kuchler	
PPIN1	Pine forest-Pacific NW-ColumbiaPlateau-Great Basin	1	Pine Forest	10	PONDEROSA SHRUB
				11	WESTERN PONDEROSA PINE
PPIN2	Pine forest-Northern & Central Rockies	1	Pine Forest	11	WESTERN PONDEROSA PINE
				16	EASTERN PONDEROSA
				18	PINE-DOUGLAS FIR
PPIN5	Pine forest-Colorado Plateau	1	Pine Forest	10	PONDEROSA SHRUB
				19	ARIZONA PINE
PPIN6	Pine forest-Southern Rocky Mts	1	Pine Forest	18	PINE-DOUGLAS FIR
				19	ARIZONA PINE
PPIN7	Pine forest-Southwest	1	Pine Forest	18	PINE-DOUGLAS FIR
				19	ARIZONA PINE
PPIN9	Pine forest-Black Hills	1	Pine Forest	16	EASTERN PONDEROSA
				17	BLACK HILLS PINE
PRAR1	Prairie Grassland	33	Prairie	70	SANDSAGE-BLUESTEM PRAIRIE
				74	BLUESTEM PRAIRIE
				75	NEBRASKA SANDHILLS PRAIRIE
				76	BLACKLAND PRAIRIE
PRAR2	Prairie With Trees	33	Prairie	70	SANDSAGE-BLUESTEM PRAIRIE
				74	BLUESTEM PRAIRIE
				75	NEBRASKA SANDHILLS PRAIRIE
				76	BLACKLAND PRAIRIE
PRAR3	Prairie With Shrubs	33	Prairie	70	SANDSAGE-BLUESTEM PRAIRIE
				74	BLUESTEM PRAIRIE
				75	NEBRASKA SANDHILLS PRAIRIE
				76	BLACKLAND PRAIRIE
RFCA	Red fir (CA)	8	Red fir (CA)	7	RED FIR
RWCA	Redwood (CA)	11	Redwood (CA)	6	REDWOOD
SAGE1	Sagebrush-Other (Silver, Wyoming)	25	Sagebrush	56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
SAGE2	Sagebrush-Other, With Trees	25	Sagebrush	56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
SCWO	Spruce - Cedar - Hemlock (WA, OR)	14	Spruce-cedar-hemlock (WA, OR)	1	SPRUCE-CEDAR-HEMLOCK
SFDF	Silver fir - Douglas fir	6	Silver fir-Douglas-fir	3	SILVER FIR-DOUGLAS FIR

FRCC		Coarse Scale		Kuchler	
SPDF	Spruce - Fir - Douglas fir	9	Spruce-fir-Douglas-fir	20	SPRUCE-FIR-DOUGLAS FIR
SPFI1	Interior West Lower Subalpine #1	16	Western spruce-fir	15	WESTERN SPRUCE-FIR
SPFI2	Interior West Upper Subalpine Forest	16	Western spruce-fir	15	WESTERN SPRUCE-FIR
				21	SOUTHWESTERN SPRUCE-FIR
SPFI5	Interior West Lower Subalpine #2	16	Western spruce-fir	15	WESTERN SPRUCE-FIR
SPFI7	Interior West Lower Subalpine #3	16	Western spruce-fir	15	WESTERN SPRUCE-FIR
				21	SOUTHWESTERN SPRUCE-FIR
SWSS1	Southwestern Shrub Steppe	27	Southwest shrub steppe	58	GRAMA-TOBOSA SHRUBSTEPPE
				59	TRANS-PECOS SHRUB SAVANNA
SWSS2	SW Shrub Steppe With Trees	27	Southwest shrub steppe	58	GRAMA-TOBOSA SHRUBSTEPPE
				59	TRANS-PECOS SHRUB SAVANNA
TSAV	Texas savanna	35	Texas savanna	60	MESQUITE SAVANNA
				61	MESQUITE-ACACIA SAVANNA
				62	MESQUITE-LIVE OAK SAVANNA
				86	JUNIPER-OAK SAVANNA
				87	MESQUITE-OAK SAVANNA
WGRA	Wet grassland	36	Wet grassland	49	TULE MARSHES
WSAG1	Sagebrush-Warm	70	Warm Sagebrush	38	GREAT BASIN SAGEBRUSH
				55	SAGEBRUSH STEPPE
				56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
WSAG2	Sagebrush-Warm, With Trees	70	Warm Sagebrush	38	GREAT BASIN SAGEBRUSH
				55	SAGEBRUSH STEPPE
				56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE

Eastern US (as of January 2005)

FRCC		Coarse Scale		Kuchler	
APOK	Appalachian Dry-Mesic Oak Forest	48	Mixed mesophytic forest	104	APPALACHIAN OAK FOREST
		49	Appalachian oak		
		50	Transition Appalachian oak-northern hardwoods		
ASLP	Appalachian Shortleaf pine	48	Mixed mesophytic forest	104	APPALACHIAN OAK FOREST
		49	Appalachian oak		
		50	Transition Appalachian oak-northern hardwoods		
AVAP	Appalachian Virginian Pine	48	Mixed mesophytic forest	104	APPALACHIAN OAK FOREST
		49	Appalachian oak		
		50	Transition Appalachian oak-northern hardwoods		
AWCF	Atlantic White Cedar	57	Loblolly-shortleaf pine	114	POCOSIN
		31	Fescue-wheatgrass	113	SOUTHERN FLOODPLAIN
AWPS	Atlantic wet pine savanna	56	Southern mixed forest	112	SOUTHERN MIXED
BEMA	Beech-Maple	47	Maple-beech-birch	102	BEECH-MAPLE
BKBE	Blackbelt	58	Blackbelt	89	BLACKBELT
BLST2	Bluestem	39	Mosaic bluestem/oak-hickory	82	Mosaic of BLUESTEM PRAIRIE and OAK HICKORY
CBPF	Conifer Bog, embedded in fire-prone system	41	Conifer bog (MN)	94	CONIFER BOG
CBPN	Conifer Bog, embedded in fire-resistant systems	41	Conifer bog (MN)	94	CONIFER BOG
CEGL	Cedar Glade	33	Prairie	83	CEDAR GLADES
CHAP5	Interior Chaparral	26	Chaparral	31	OAK-JUNIPER
				32	Transition between OAK-JUNIPER and MOUNTAIN MAHOGANY-OAK
				37	MOUNTAIN MAHOGANY-OAK
DSHB1	Salt Desert Shrubland	28	Desert shrub	40	SALTBUSH-GREASEWOOD
DSHB2	Desert Shrubland with Grasses	28	Desert shrub	39	BLACKBRUSH
				40	SALTBUSH-GREASEWOOD
				41	CREOSOTE BUSH
				42	CREOSOTE BUSH-BUR SAGE

FRCC		Coarse Scale		Kuchler	
				43	PALO VERDE-CACTUS SHRUB
				44	CREOSOTE BUSH-TARBUSH
				57	GALLETA-THREE AWN SHRUBSTEPPE
				58	GRAMA-TOBOSA SHRUBSTEPPE
DSHB3	Desert Shrubland with Grasses and trees	28	Desert shrub	39	BLACKBRUSH
				40	SALTBUSH-GREASEWOOD
				41	CREOSOTE BUSH
				42	CREOSOTE BUSH-BUR SAGE
				43	PALO VERDE-CACTUS SHRUB
				44	CREOSOTE BUSH-TARBUSH
				57	GALLETA-THREE AWN SHRUBSTEPPE
				58	GRAMA-TOBOSA SHRUBSTEPPE
DSHB4	Desert Shrubland (without grasses)	28	Desert shrub	39	BLACKBRUSH
				40	SALTBUSH-GREASEWOOD
				41	CREOSOTE BUSH
				42	CREOSOTE BUSH-BUR SAGE
				43	PALO VERDE-CACTUS SHRUB
				44	CREOSOTE BUSH-TARBUSH
				57	GALLETA-THREE AWN SHRUBSTEPPE
				58	GRAMA-TOBOSA SHRUBSTEPPE
EGSG	Everglades Sawgrass	36	Wet grassland	92	EVERGLADES
ELAS	Elm-Ash	46	Elm-ash forest	101	ELM-ASH
EPWM	Eastern Prairie-Woodland Mosaic	49	Appalachian oak	104	APPALACHIAN OAK FOREST
				105	MANGROVE
				106	NORTHERN HARDWOODS
ESPF1	Southern Appalachian spruce-fir	43	Eastern spruce-fir	97	SOUTHEASTERN SPRUCE-FIR
GLSF	Great Lakes Spruce Fir	43	Eastern spruce-fir	93	GREAT LAKES SPRUCE-FIR

FRCC		Coarse Scale		Kuchler	
JP1	Jack Pine	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
JPBS	Jack Pine-Black Spruce	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
JPOP	Jack Pine Openland	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
JPRP	Jack Pine-Red Pine	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
LLBS	Longleaf Bluestem	56	Southern mixed forest	112	SOUTHERN MIXED
LLPM	Longleaf Mesic Uplands	56	Southern mixed forest	112	SOUTHERN MIXED
LLSH	Longleaf Sandhill	56	Southern mixed forest	112	SOUTHERN MIXED
MABA	Maple-Basswood	45	Oak-hickory	99	MAPLE-BASSWOOD
MARF	Maritime Forest	59	Oak-gum-cypress	90	LIVE OAK-SEA OATS
MBOA	Maple-Basswood-Oak-Aspen Mosaic	44	Maple-basswood	81	OAK SAVANNA
				99	MAPLE-BASSWOOD
MMHF	Mixed Mesophytic Forest	48	Mixed mesophytic forest	104	APPALACHIAN OAK FOREST
		50	Transition Appalachian oak-northern hardwoods		
NEOP	Northeastern Oak-Pine	54	Northeastern-oak-pine	110	NORTHEASTERN OAK-PINE
NESF	Northeastern Spruce-Fir	43	Eastern spruce-fir	96	NORTHEASTERN SPRUCE-FIR
NHDW1	Northern Hardwoods #1	49	Appalachian oak	106	NORTHERN HARDWOODS
		50	Transition Appalachian oak-northern hardwoods		
		51	Northern Hardwoods		
NHDW2	Conifer-Northern Hardwoods	49	Appalachian oak	106	NORTHERN HARDWOODS
		50	Transition Appalachian oak-northern hardwoods		
		51	Northern Hardwoods		
NHDW3	Northern Hardwoods #2	49	Appalachian oak	106	NORTHERN HARDWOODS
		50	Transition Appalachian oak-northern hardwoods		
		51	Northern Hardwoods		
NHFI	Northern Hardwood-Fir	52	Northern hardwoods-fir	107	NORTHERN HARDWOODS-FIR
NHSP	Northern Hardwoods-Spruce	53	Northern hardwoods-spruce	108	NORTHERN HARDWOODS-SPRUCE
NMAR	Northern Salt Marsh	36	Wet grassland	73	NORTHERN CORDGRASS PRAIRIE

FRCC		Coarse Scale		Kuchler	
NOFP	Northern Floodplain Forest	60	Northern floodplain	98	NORTHERN FLOODPLAIN
NOKS	Northern Oak Savannah	44	Maple-basswood	81	OAK SAVANNA
NTPR	Northern Tallgrass Prairie	33	Prairie	74	BLUESTEM PRAIRIE
OAKF	Oak Flats	56	Southern mixed forest	112	SOUTHERN MIXED
		55	Oak-hickory-pine	111	OAK-HICKORY-PINE
OCWI	Oak and Conifer Woodlands Interior Soutwest	26	Chaparral	31	OAK-JUNIPER
OKHK1	Eastern Dry-Xeric Oak	45	Oak-hickory	100	OAK-HICKORY
OKHK2	Western Dry-Xeric Oak	45	Oak-hickory	100	OAK-HICKORY
OKHK3	Western Mixed Mesophytic	45	Oak-hickory	100	OAK-HICKORY
OKHK4	Oak Hickory Northeast	45	Oak-hickory	100	OAK-HICKORY
OKPN2	Oak-Hickory-Pine	55	Oak-hickory-pine	111	OAK-HICKORY-PINE
PAPR	Palmetto Prairie	36	Wet grassland	79	PALMETTO PRAIRIE
PCSN	Pocosin	57	Loblolly-shortleaf pine	114	POCOSIN
		56	Southern mixed forest	112	SOUTHERN MIXED
PDPN	Pond Pine Forest	56	Southern mixed forest	112	SOUTHERN MIXED
PFPF	Piedmont Floodplain Forest	55	Oak-hickory-pine	111	OAK-HICKORY-PINE
PGRA1	Northern Plains Grassland	32	Plains grassland	67	WHEATGRASS-BLUESTEM-NEEDLEGRASS
PGRA4	Southern Plains Grassland (without trees or shrubs)	32	Plains grassland	65	GRAMA-BUFFALOGRASS
PGRA5	Southern Plains Grassland (without trees or shrubs)	33	Prairie	69	BLUESTEM-GRAMA PRAIRIE
PGRA6	Southern Plains Grassland (without trees or shrubs)	34	Desert grassland	85	MESQUITE-BUFFALO GRASS
POHS	Piedmont Oak-Hickory-Shortleaf Pine	55	Oak-hickory-pine	111	OAK-HICKORY-PINE
PRAR1	Prairie Grassland (without trees or shrubs)	33	Prairie	70	SANDSAGE-BLUESTEM PRAIRIE
PRAR5	Bluestem Prairie, mixed and tallgrass prairie	33	Prairie	75	NEBRASKA SANDHILLS PRAIRIE
PRAR6	Blackland Prairie	33	Prairie	74	BLUESTEM PRAIRIE
PRAR7	Bluestem-Sacahuista Prairie	33	Prairie	88	FAYETTE PRAIRIE
RPWP	Red Pine-White Pine	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
RPWP2	Great Lakes pine forest: Red pine-White Pine #2	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
SEOK4	Xeric Pine-Oak, Western	55	Oak-hickory-pine	111	OAK-HICKORY-PINE

FRCC		Coarse Scale		Kuchler	
SFPM	South Florida Coastal Prairie - Mangrove	59	Oak-gum-cypress	105	MANGROVE
		49	Appalachian oak		
SFSP1	South Florida Slash Pine	56	Southern mixed forest	116	SUBTROPICAL PINE
SHIN	Shinnery	29	Shinnery	71	SHINNERY
SMAR	Salt Marsh (southern)	36	Wet grassland	78	SOUTHERN CORDGRASS PRAIRIE
SOFP	Southern Floodplain	61	Southern floodplain	113	SOUTHERN FLOODPLAIN
SPSC	Sand Pine Scrub	57	Loblolly-shortleaf pine	115	SAND PINE SCRUB
SWISS1	Southwest Shrub Steppe (without trees)	27	Southwest shrub steppe	58	GRAMA-TOBOSA SHRUBSTEPPE
				59	TRANS-PECOS SHRUB SAVANNA
SWISS2	Southwest Shrub Steppe (with trees)	27	Southwest shrub steppe	58	GRAMA-TOBOSA SHRUBSTEPPE
				59	TRANS-PECOS SHRUB SAVANNA
SWPS	Gulf Coast wet pine savanna	56	Southern mixed forest	112	SOUTHERN MIXED
				116	SUBTROPICAL PINE
TMPP	Table Mtn Pine-Pitch Pine	48	Mixed mesophytic forest	104	APPALACHIAN OAK FOREST
		49	Appalachian oak		
		50	Transition Appalachian oak-northern hardwoods		
TSAV	Texas Savanna	35	Texas savanna	45	CENZIA SHRUB
		36	Wet grassland	60	MESQUITE SAVANNA
		37	Alpine meadows-barren	61	MESQUITE-ACACIA SAVANNA
WPHE	Great Lakes pine forest: White pine-Hemlock	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
WPHE2	Great Lakes pine forest: White Pine-Hemlock #2	42	Great Lakes pine forest	95	GREAT LAKES PINE FOREST
XTMB1	Cross timbers	40	Cross timbers	84	CROSS TIMBERS
		45	Oak-hickory		

Appendix E: Troubleshooting in VDDT

Whenever you get errors in VDDT, crash the program, or have trouble graphing, check each of the following.

1. Check that your definition files (cover.txt, coverc.txt, structur.txt, distcode.txt, distgrp.txt) are not read-only.
    - Open Windows Explorer (right-click on Start, select Explore)
    - Navigate to the definition files (either in folder DefinitionFiles for the RA model templates or in file 1FRCCdef_files for FRCC models.)
    - Select each of the text files individually, right click, and select Properties. Make sure Read-Only isn't checked for each.
2. Check that the model template you are using is not read-only.
    - Open Windows Explorer (right-click on Start, select Explore)
    - Navigate to folder where the template is stored
    - Select each of the model files individually (*.pvt, *.loc, *.scn), right click, and select Properties. Make sure Read-Only isn't checked for each.
3. Make sure that you have the proper graphics files loaded.
    - Open Windows Explorer (right-click on Start, select Explore)
    - Navigate to C:\WINDOWS\SYSTEM32
    - Look for the files listed in the table below. The files in **bold** are the most frequent problems.

File	*Minimum Version*	*Registration**
VSFlex3.OCX	**3.0.0.36**	**Register**
VSFlex6.OCX	**6.0.0.73**	**Register**
VSFlex6d.OCX	**6.0.0.73**	**Register**
Graph32.OCX	**1.0.0.47**	**Register**
GSW32.exe	**5.5**	**May not register**
GSWDLL32.DLL	**5.5**	**May not register**
COMCAT.DLL	4.71	Register
GSWAG32.DLL	5.5	May not register
MFC42.DLL	6.00.8267	Register
MSVCRT.DLL	6.00.8267	Non-registering
OLEAUT32.DLL	2.30.4265	Register
OLEPRO32.DLL	5.04265	Register

*See step 4 below.

- If a file is not present on your hard drive, copy it from the CD (RAModeling\Windows Troubleshooting) into C:\WINDOWS\SYSTEM32.

- Make sure the file you just copied isn't read-only. Right-click on it and select <u>Properties</u>. Make sure <u>Read-Only</u> isn't checked.

- Proceed to step #4.

4. If you had to copy any of the graphics files above (step 3), make sure that they are registered. If the file is listed as non-registering in the table above, you do not need to register it (for those listed as *may not register*, you should follow these steps to try to register them).

   - Copy the small program <u>RegDrop.exe</u> from the CD (RAModeling\Windows Troubleshooting\RegDrop.exe) directly onto your desktop.

   - Open Windows Explorer (right-click on <u>Start</u>, select <u>Explore</u>)

   - Navigate to <u>C:\WINDOWS\SYSTEM32</u>

   - Select the file you wish to register and drag and drop it on top of the RegDrop icon on your desktop. A message telling you whether or not the file registered should appear.

Appendix F: Modeling Cheatsheet

Starting A Model

1. Point to the **Definition Files**:
   A. In VDDT, go to File—Use New Definition Files.
   B. Select All Files.
   C. Navigate to C:/VDDT/RAModeling/Definition Files.
   D. Double-click on distcode.txt.

2. **Open** a model:
   A. Go to File—Open PVT Files.
   B. Navigate to the model you'd like to load.
   C. Double-click on the model's *.PVT file, then double-click on the *.SCN and *.LOC files.

3. **Save** your model (see box at right).

Changing the 5 Boxes

1. There can be no more than 5 boxes.
2. To delete a box, go to Diagram—Delete a class.
3. To add a box, go to Diagram—Add new class.
4. To change a name of a box, go to Diagram—Edit a class.

Saving a model to its current name and directory

1. Go to File—Save Files (pvt, scn, loc).

Saving a model to a new name or directory

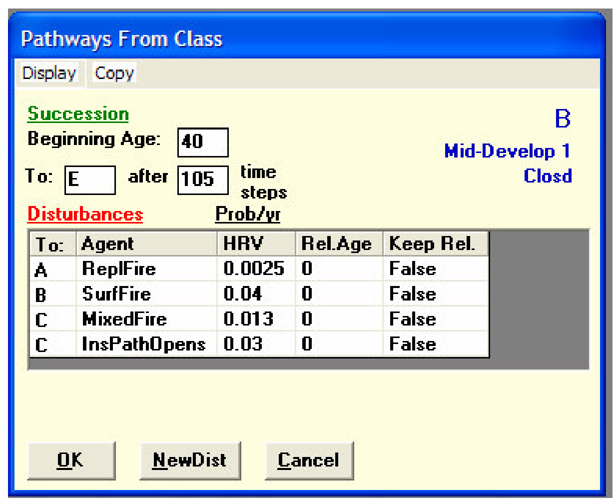
1. Go to File—Save Files As (new format).
2. Navigate to where you'd like to save the model (c:\VDDT\RAModeling\MyModels).
3. Type the name of the model (the model's code).
4. Click Save three times—once each for the PVT, SCN, and LOC files. If an asterisk appears in the title of the file, delete it before clicking save.

Inputs

1. Double-click any box to enter inputs. The dialogue box at right will appear. The name of the class is shown in the upper right corner.

2. **Ages**: Input the beginning age of the class and the number of years (timesteps) that class lasts. To determine the ending age of the class, add the beginning age and timesteps together.

3. **Succession pathway**: Enter the main successional pathway in the To: box. There can only be one main succession pathway. You can enter additional "alternative succession" pathways as disturbances (see below).



4. **Disturbances**:
   A. In the To: column, enter the new class a disturbance will cause a transition toward. A disturbance cannot accellerate a pixel's age.
   B. In the Agent column, enter the disturbance type.
      i) To add a disturbance, click on the NewDist button. Use the Modeling Manual to determine which disturbance to add.
      ii) To delete a disturbance, delete the letter in the To: column and then click ok. A dialogue box will appear to verify that you want to delete the class. Click yes.
   C. In the HRV column, enter the probability of that disturbance pathway occuring. Probability is the inverse of frequency (i.e., 1/frequency in years).
   D. In the RelAge column, leave 0 unless (1) you are in class A, and (2) the disturbance maintains the class A, and (3) the disturbance resets the age of the pixels to 0.
   E. Always leave the KeepRel column set to False.

Running the Model

1. Go to Run Model—Edit Initial Conditions.
   A. Under Number of Pixels to Simulate, enter 1000
   B. In Total Area in PVT, enter 1000
   C. Hit the Recalc button and then hit OK.

2. If you used Time Since Disturbance (TSD), go to Run Model—Select TSD Group. Select All Fire and click OK.

3. Go to Run Model—Time Definitions.
   A. Under Number of Timesteps to Simulate, enter 500 (or 1000).
   B. Under Number of Simulations, enter a number between 1 and 10. When testing the final model, you should run at least 10 simulations.
   C. Select Run.

TSD (Time Since Disturbance)

1. If the PNVG is fire-maintained, set the main successional pathway along an open path (e.g., A-C-D).
2. Double-click one of the open classes (e.g., C or D). Go to Display—Show TSD col.
3. Click on the NewDist button.
4. In the Agent column, select Alternative Succession from the drop-down menu.
5. In the To: column, enter the alternative successional pathway from the open type to the closed type (e.g., To: B).
6. In the HRV column, enter a probability of 1.
7. In the TSD column, enter the number of years that would have to occur without fire in order to transition to the closed class.
8. Before you run the model, go to Run Model—Select TSD Group and select AllFire.

Outputs

ii. To view the **percent of the landscape in each class**:
   A. Go to Results—View ending Conditions. The table shows the percent in each class at the end of your run. *OR*
   B. Go to Results—Bar—Class. The bar graph shows the percent of the landscape (y-axis) in each class (x-axis). *OR*
   C. Go to Results—Time—Class. Enter up to four classes to view. The line graphs show the percent of the landscape (y-axis) in each class (individual graphs) over time (x-axis).

iii. To view the **probability of fire and other disturbances**:
   A. Go to Results—Time—Disturbance. Select up to four disturbances to view.
   B. The line graphs show the percent of the landscape (y-axis) that was affected by each disturbance (individual graphs) over time (x-axis).
   C. To convert the percent of the landscape affected by the disturbance (y-axis) to a probability, multiply the y-axis value by 0.01.

Recommended Graph Options

To change graph options, go to Reults—Graph Options.

- Same y-axis will show all time graphs with the same scale.

- Show Average, Min, Max will display the average of all runs, the minimum of all runs, and the maximum of all runs on time graphs.

- Show Mean Line—For Average Only will:
  - display a mean of the average of all runs at the intervals you request. Enter intervals like 100, 500 to show the average of your model during and after a 100-year calibration period.
  - Display a table with each time graph that shows the precise average for each requested interval.

Appendix G: Modeling Worksheet

Model Input Worksheet

	Notes	To A	To B	To C	To D	To E
From A						
From B						
From C						
From D						
From E						

Model Output Worksheet

	Notes	*Run 1*	*Run 2*	*Run 3*	*Run 4*	*Run 5*	*Run 6*	*Run 7*	*Run 8*	*Run 9*	*Run 10*
A%											
B%											
C%											
D%											
E%											
AllFire											
Repl											
Mixed											
Surf											

Summary of Modifications

Run 1.

Run 2.

Run 3.

Run 4.

Run 5.

Run 6.

Run 7.

Run 8.

Run 9.

Run 10.

Appendix H: External Peer Review

The instructions and form shown here will be sent to volunteer reviewers for every model, along with a model description and VDDT files. Some of the reviewers will have attended modeling workshops.

LANDFIRE Rapid Assessment Reference Model Review

Thank you for participating in the peer review of LANDFIRE successional models for the Rapid Assessment. Your informed feedback is critical to the successful development of robust models that incorporate the best available science and knowledge to-date.

Instructions

Download the Data Files

1. Your regional lead will email you the model files for your model zone. In the zipped folder he or she sends you, you will find a folder for every PNVG in the model zone. Select only those you are interested in reviewing. In each PNVG's folder, you will find:
   - A PDF document (named CODE.pdf) that documents the details of the model, including assumptions and results. All reviewers should look at this document.
   - Three VDDT files (named CODE.pvt, CODE.scn, and CODE.loc). You'll need these to examine the model in the VDDT software.

2. Using Internet Explorer or another web browser, go to the following web site to download additional review materials:
   [web address provided]

3. Download the *RAModeling* folder to your hard drive. Unzip it using WinZip or a similar application. (This folder contains background material, is referenced throughout the *RA Modeling Manual,* and contains files necessary if you decide to perform your review using VDDT.) It contains:
   - ***Definition Files*** folder containing the five VDDT definition files needed to run all Rapid Assessment Reference Condition models in VDDT.
   - ***RA Modeling Help*** folder containing:
     - ***Cheatsheet.pdf***: a step-by step cheatsheet to the RA modeling standards.
     - ***Lumper-Splitter Personality Quiz.pdf***: a fun way to test your modeling tendencies.
     - ***Modeling Exercise.pdf***: an exercise that will test your VDDT skills.
     - ***RA Modeling Manual v2.0.pdf***: the complete modeling manual. Also available at www.landfire.gov/workshop.html.
     - ***Worksheet.pdf***: a worksheet that will help you track inputs and outputs as you model in VDDT.
   - ***VDDT Test*** folder containing a sample VDDT model, used in the Modeling Exercise (above).
   - ***WindowsTroubleshooting*** folder containing files and instructions for troubleshooting errors and crashes in VDDT.
   - ***Map Mapzones.pdf:*** maps of LANDFIRE Mapzones for every Model Zone. This will help you answer question 3d on the Model Review Form.
   - ***Map Sections.pdf:*** a map of Bailey's Sections for every Model Zone. This will help you answer question 3d on the Model Review Form.

- ***Model Review Form.doc***: the form you will complete for each model you choose to review.

Read Background Material

4. Read Chapters 1 and 2 in the *RA Modeling Manual* (Background and Potential Natural Vegetation Groups). This can be found in the *RA Modeling/RA Modeling Help* folder.

5. Skim the rest of the *RA Modeling Manual* to become familiar with model capabilities and limitations.

Conduct your Review

6. Review the potential natural vegetation group (PNVG) Description Documents for the models. These can be found in folders named with the model code and are PDF documents.

7. Determine whether you are going to perform your review via interactively playing with the actual VDDT model (optional but preferred), or via review of PNVG descriptions.

8. If you decide to perform the review using VDDT, download the Vegetation Dynamics Development Tool (VDDT) modeling software (www.essa.com). The software is free and you will find instructions for installing the software in Chapter 3 of the *RA Modeling Manual*. Chapter 4 of the *RA Modeling Manual* explains how to get started in VDDT. You may also want to do the Modeling Exercise (RAModeling/RA Modeling Help/Modeling Exercise.pdf) using the VDDT Test files.

9. If you decide to review the models using only the PNVG Description Documents, read each document carefully. Contact your regional lead if you would like more information about the model that isn't contained in the description document.

10. Complete the attached PNVG Model Review Form.
    - Rank your knowledge for each PNVG reviewed, and document how your knowledge may vary geographically.
    - Answer questions provided about the PNVG model inputs and description.
    - Contact your regional lead if you have any questions or if the process needs clarification.

11. By [regional deadline], submit your reviews for each PNVG electronically (email or CD) via the provided form to:

    [Regional Lead]
    [Email Address]
    [Mailing Address]
    [Phone]

LANDFIRE Rapid Assessment Model Review Form

1. Save this form with your last name and the name of the PNVG. Go to *File—Save As* and enter: *Name_PNVG*.doc.

2. Basic Information			
Date of review:	**PNVG name:**		
Name:	**Model Zone(s):**		
Title:	**Address:**		
Affiliation:	**City:**	**State:**	**Zip:**
Phone:	**Email:**		
Anonymity: (select one)	☐ **I would like my name listed as a reviewer.** (If you select this option, your feedback will be incorporated and your name will be listed on the PNVG description as a reviewer.)		
	☐ **I would like to be an anonymous reviewer.** (If you select this option, your feedback will be incorporated and only the regional lead and national staff will know your name.)		

3. Rank your knowledge of this PNVG.			
	Expert[a]	**Knowledgeable**[b]	**Familiar**[c]
a) How would you rate your understanding of the fire regime of this PNVG throughout the entire model zone?	☐	☐	☐
b) How would you rate your understanding of the successional processes of this PNVG throughout the entire model zone?	☐	☐	☐
c) How would you rate your understanding of the composition and structure of this PNVG throughout the entire model zone?	☐	☐	☐
d) If your fire-related knowledge varies considerably geographically, please to indicate how it may vary by mapping zone or province. Leave blank if there is no substantial variation.	Mapzone Numbers: Province Numbers:	Mapzone Numbers: Province Numbers:	Mapzone Numbers: Province Numbers:

[a]*Expert*: **In this PNVG**, you have directed research or have at least 5 years of field experience, **and** feel confident in your understanding of the vast majority of related fire and/or other literature published in major professional journals.

[b]*Knowledgeable*: **In this PNVG**, you have participated in research or have at least 3 years of field experience, **and** are familiar with some related fire and/or other literature published in major professional journals.

[c]*Familiar*: **In this PNVG**, you have not directly participated in research and have less than 3 years field experience, but feel confident in your understanding of the majority of related fire and/or other literature published in major professional journals.

4. Determine how you will perform your review. Reviews can be performed via interactively playing with the actual VDDT model (optional but preferred), or via review of PNVG descriptions and tables of model inputs. If you choose to use VDDT software to review the models, ensure that you attribute the time definitions with at least 500 years (time steps), and use 10 Monte Carlo simulations.		
	Review of PNVG descriptions, tables of model inputs and the actual VDDT model	**Review of PNVG descriptions and tables of model inputs only**
I performed this review via	☐	☐

5. Review the PNVG description and model inputs, and answer the following questions.
If you do not know the answer to any of the following questions, please enter "do not know". Assume that the reference fire regime and vegetation/fuels input and described for each PNVG reflect historic conditions (i.e., pre-European settlement); and expected conditions if a natural fire regime were allowed to operate freely. Burning by Native Americans may or may not be considered part of the natural fire regime. Models are NOT intended to include states or processes that result from human-induced disturbances or management actions (except possibly Native American burning), and are constrained by the standardized model structure for this project (i.e., 3-5 states (boxes) per model).

5a. Rank this model overall. Check one box for each row to classify your review overall. If you reject the model outright, please explain in further detail below.				
	Accept as-is	**Needs minor editing**	**Needs major editing**	**Reject outright (please select one option for each row)**
Model Description	☐	☐	☐	☐ **Model is redundant with another PNVG (please specify):** ☐ **Model is not well-thought out or researched, for the reasons explained in the questions below.** ☐ **Other:**
VDDT Model	☐	☐	☐	

<table>
<tr><td colspan="3">Introduction and Description
The introductory PNVG descriptions are intended to briefly describe the key factors that set this PNVG apart from other PNVGs. It should describe the geographic extent, biophysical site (e.g., major landform position, geologic substrate, elevation range), the vegetation, disturbance regimes, common adjacent PNVGs, and scale or patch size.</td></tr>
<tr><td>5b.</td><td>Do the introductory descriptions adequately capture its distribution across the model zone? If not, what specifically should be added or removed from this description?</td><td></td></tr>
<tr><td colspan="3">Mosaic of model classes A-E
Model outputs summarizing the expected proportion of each of the reference model states (A-E) in the PNVG reflects the result of successional and disturbance processes operating concurrently over the long term.</td></tr>
<tr><td>5c.</td><td>Do the reference model state descriptions (A-E) appear to encompass the full spectrum of reference states (structure and indicator species/genera/life form composition) within the context of the standardized model structure (e.g., 3- to 5-box model)?</td><td></td></tr>
<tr><td>5d.</td><td>Do the proportions of states A-E appear to reflect the landscape scale mosaic for this PNVG (± 10% for any one state) given a historic or reference fire regime?</td><td>If No, please select one option:

☐ The proportions are inaccurate for the entire geographic area this model covers and the model should be rejected and remodeled. (Please complete additional questions above so that we know how to remodel this type.)

☐ The proportions are inaccurate for a subset of the geographic area this model covers, including these areas:</td></tr>
<tr><td colspan="3">Disturbance Inputs
Disturbance frequencies are translated to annual probabilities (1/ frequency in years) when entered into the VDDT model. Each disturbance can operate with different frequencies (i.e., different probabilities) and cause different transitions (i.e., have different effects) in different classes (i.e., boxes A-E). Fire disturbances are categorized in three severity classes (surface = <25% top-kill; mixed = 25-75% top-kill; replacement = >75% top-kill). Additional disturbances types may be modeled.</td></tr>
<tr><td>5e.</td><td>Does the range in fire frequency (fire return intervals) adequately capture the best available information for the potential natural vegetation group (PNVG) described?</td><td></td></tr>
</table>

5f.	**Are there sources of published literature on fire frequency that appear to be missing** and which will change the range or central tendency of fire frequency used in the model if it were included? If so, provide the full citation of literature that should be considered.	
5g.	**Do the differences in annual fire probabilities for each fire severity type by state appear to capture the best available information on how fire frequency and type are distributed throughout this PNVG?** If not, specifically what should be changed within the model?	
5h.	**Does the distribution of fire severity between stand replacement and non-stand replacement regimes adequately capture the best available information** for the potential natural vegetation group (PNVG) described?	
5i.	**Are there sources of published literature on fire severity that appear to be missing** and which will change the distribution of fire severity used in the model if it were included? If so, provide the full citation of literature that should be considered.	
5j.	**Are there any major non-fire related disturbances (e.g., hurricanes, insects) that have not been captured by the model?** If so, what are they? For each, what would you estimate are their mean, minimum and maximum return intervals and severities (e.g., stand replacement, mosaic)? Which states (A-E) do each operate in?	
Additional Feedback		
5k.	Other comments, suggestions, or feedback.	

THANK YOU FOR COMPLETING THE MODEL REVIEW!